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Aluminum.

Few of us realize how rapid of late has been the advance in the use of aluminum. Until very recent years we have known only of its one peculiarity of lightness, and we were prohibited from knowing more by its costliness. In 1876 it was almost a precious metal, and a surveyor's transit of aluminum at the Philadelphia Centennial Exhibition was doubly an object of interest, by its embodiment of these two elements of levity and cost. Even as late as 1885 50,000 pounds represented the world's annual production and use of the metal, while now in the United States alone we are daily producing nearly one-half of that amount, and it seems as certain as anything can be that this growth of production and use must continue to go on with unabated rapidity. If there is any industry apparently more certain as to its future than the production of aluminum we do not know where to find it. The use of aluminum is extending at present most rapidly in electric service, where its cheapness is crowding out copper as a conductor. Ten large power transmission plants and twenty-five electric railway and electric light plants are now equipped with aluminum conductors, and the indications are that this one use will consume thousands of tons of the metal each year. For the various service where the lightness of the metal, in combination with its cheapness, is its great recommendation, as in all classes of army equipment, and in all the various articles of personal or household use which are frequently or constantly handled, the growth in the use of the metal is more rapid than ever. For a time there was a tendency to overdo in the matter of lightness, and many articles were made unreasonably thin, and the metal was unjustly condemned in consequence, but this matter has now adjusted itself, and articles are now made strong enough and still can boast of their lightness. It is a curious circumstance that the Japanese are to-day possibly using more aluminum than any other foreign nation, and India also supplies a great market for the metal. Aluminum was long regarded with distrust for culinary service, but it has been amply proved to be non-poisonous, and in this wide field it is sure to make rapid strides. An apparently very sensible suggestion, which is being carried into extensive and systematic experiment by the United States and some other governments, is the substitution of aluminum for copper for the minor coinage of the world. Copper carries not only its own poisonous verdigris, but all manner of disease germs to boot, which aluminum would not. Our knowledge of the mechanical properties and capabilities of aluminum is by no means what it should be. We have a general notion that it is valuable as an element in various alloys, but we know little more than that, and its use as yet in machinery is comparatively quite small, and probably much smaller than it should be. We should especially know much more than we do of its qualities as a bearing metal, both in its comparatively pure state and in its various alloys. Who knows how it will wear for bearings and rods and sliding surfaces generally? There may have been some isolated trials of it, and of those who has heard? But there certainly have been no such trials as the present status of the metal would seem to demand.

The Russian Market for Machine Tools.

An official Russian report just published in St. Petersburg gives some interesting data on Russian stock companies. The dividends paid by these companies during the year 1899 vary between 1½ and 30 per cent. The well-known "Bryansk Rail Works," at Orel and at Ekaterinoslav, increased its capital from 400,000 rubles in 1873—the year of the foundation of the company—to 8,087,500 rubles in 1899. The profits of the company in 1899 amounted to no less than 3,625,993 rubles, out of which a dividend of 30 per cent. was paid. The company intends to issue bonds this year to the amount of 8,000,000 rubles, for the purpose of enlarging its plants, and there should be an opportunity for the sale of American machinery and tools.

The "Kolomna Machine Works," whose head offices are at Golutvin, were founded in 1871 with a capital of 2,000,000 rubles, which has in the meantime been increased to the amount of 5,000,000 rubles. The company during the last year yielded a profit of 1,002,076 rubles, and paid a dividend of 14 per cent. They now intend increasing their capital by 1,000,000 rubles, also for the enlargement of their plants, and there should be another chance for the sale of American machine tools. The "St. Petersburg Metal Works," founded as early as 1850, with a capital of 800,000 rubles, which has been increased since then to 3,600,000 rubles, can also look back upon a successful year of operation. The profits amounted in 1898-99 to 587,075 rubles, and the company was able to pay a dividend of 15 per cent. Of later date is the company styled as "East Siberian Iron Foundries." This company was founded in 1896, with a capital of 4,500,000 rubles. Its headquarters are at Moscow, while the plants, machine shops and foundries are in Siberia, at Tomsk and at Irkutsk. The company has now received permission from the Imperial Government to increase its capital by 4,500,000 rubles. The works at Tomsk, as well as those at Irkutsk, are to be considerably enlarged. We may mention in this connection that both cities are very important points on the Great Siberian Railway line. Tomsk has a population of about 65,000 souls. There is a university, a technical high school, a manual training school, etc.; the city is lighted by electricity and has a good telephone system. The old established house of E. Koukhterin & Co. keeps always a large, well assorted stock in tools. Messrs.

Jakimoff & Nekrasoff also deal in all kinds of small tools.

Irkutsk is situated on Lake Baikal, and is now in regular railway communication with Moscow and St. Petersburg. Here are concentrated the headquarters of the administration of the western part of the Great Siberian Railway and the main offices of the postal and telegraphic administration. Irkutsk is the commercial metropolis of Western Siberia. In its immediate neighborhood large and rich deposits of iron and bituminous coal have been discovered, and there is every prospect of Irkutsk becoming some day a great Siberian iron manufacturing center.

The "B. Hantke Metal Works," founded in 1882 with a capital of 500,000 rubles, later on increased to 1,500,000 rubles, have their headquarters at Warsaw, and plants at that place and at Ekaterinoslav. Last year they were able to pay a dividend of 16 per cent. The company intends to issue bonds this year to the amount of 1,250,000 rubles, chiefly for the purpose of enlarging the capacity of its works.

The "W. G. Stoll & Co. Mechanical Works," of Voronezh, paid a dividend of 25 per cent. on a capital of 250,000 rubles. The company intends increasing its capital this year, with the object of enlarging its workshops at Voronezh.

Russia's industrial progress is, in fact, marvelous. In 1899 no less than 363 joint stock companies, with an aggregate capital of 427,421,250 rubles, were founded! Of these 57 were foreign enterprises.

Forty-four of these companies are to establish foundries, steel works, machine shops and shipbuilding yards. These forty-four companies have a capital of 49,655,000 rubles. Fifteen companies, with an aggregate capital of 35,500,000 rubles, will engage in mining. The principal one of them is the "Kertch Company" (Crimea), capitalized at 10,000,000 rubles.

The textile industry is represented by thirty-three companies, capitalized at 35,750,000 rubles. The leading companies are to establish mills at Reval and at Lodz, the "Polish Manchester."

Seven companies, with an aggregate capital of 8,900,000 rubles, of which the most important are those known as "Force Electrique," in the Transcaucasus (4,000,000 rubles capital), and "Volta Company," at Reval (1,500,000 rubles), will devote themselves to the electrical field.

There is scarcely a line of manufacture which is not included in these new foundations. Thus we find 7 steamship companies; 27 companies for the manufacture of building material; 14 silk factories; 14 paper mills; 6 beer breweries; 2 powder factories; 5 wire nail and cable works (the principal ones being "Rieben," of St. Petersburg, and "Wojanowski," of Warsaw); 6 glass works; 3 match factories; 4 oil mills; 3 flour mills, etc.

In 1899 the imports of machinery alone into Russia amounted in value to about $27,000,000, chiefly from Germany, Great Britain, Belgium and other European manufacturing countries. Our share was very small. According to our official returns we sent during the last fiscal year the following direct shipments to Russia: Electrical machinery, $66,591; machine tools, $338,694; printing machinery, $950; pumps and pumping machinery, $231,814; shoe machinery, $11,707; locomotives, $640,130; stationary steam engines, $1,575; boilers and parts of engnes, $37,245; agricultural machinery and implements—(a) mowers and reapers, $841,032; (b) plows and cultivators, $13,887; (c) all other, $56,030; all other machinery, $451,500.

Thus, we get a grand total of $2,691,155, or less than 10 per cent., of the total Russian machinery imports.

For many years to come the industrial development of Russia will doubtless continue, and this market should be closely watched. H. L. G.

Technical Publication.

"Our New Prosperity." By Roy Stannard Baker. New York: Doubleday & McClure Company. 285 pages, 7½ x 5 inches. Price $1.25.

This is an eminently interesting and readable book which is all through true to its title. It presents in a variety of forms the facts and figures of our present profitable activity. It is a book for the time and should be read at once, like the latest novel. Of the causes of our prosperity it has little to say, and of how our prosperity is to be maintained nothing at all. In fact, at the end it says: "The country must expect another back-set, another period of hard times, tight money, mortgages, discontent and distress. It will come in the natural course of events," and so on, with no suggestion of any means of avoiding it.

"The Steam Engine Indicator." By Cecil H. Peabody. New York, John Wiley & Sons. 153 pages 7x5¾ inches; 98 cuts. Price, $1.50.

From our view point it may be proper to say, as perhaps our word of highest commendation, that there is nothing in this book which suggests that it is the work of a college professor. It is entirely and thoroughly practical, and no theory and no mathematical sleight of hand is obtruded. It might have been the work of any steam engineer, and any steam engineer of good common school education will browse with perfect freedom over every page of it. All possible information connected with the indicator in its various types, and all the various apparatus used in connection with it, seem to be here collected, with copious information as to all the manipulations and subsequent computations involved. This is all gone into so fully that little space is given for the exhibition of freak diagrams, although typical diagrams of the various types of engines, pumps, air compressors, etc., are given and their special points sufficiently discussed. The book is an eminently serviceable one for all who do not already know all about the steam engine indicator.

Personal.

M. Morton, president of the Morton Manufacturing Company, Muskegon Heights, Mich., sailed on June 2 for a three months' trip to Europe.

After an absence of six months, E. W. Saunders has resumed his position as salesman for the Pratt & Whitney Company at their New York store, 123 Liberty street.

J. W. Duntley, president of the Chicago Pneumatic Tool Company and of the New York Air Compressor Company, has just returned from a highly successful European tour.

B. W. Grist, formerly with the Pennsylvania Iron Works, has been appointed general superintendent of the works of Riehle Bros. Testing Machine Company, 1,424 North Ninth street, Philadelphia.

Eugene C. Peck, lately superintendent of the S. W. Card Manufacturing Company, Mansfield, Mass., has resigned that position to become mechanical engineer and chief draftsman of the Cleveland Twist Drill Company, Cleveland, Ohio.

Obituary.

John Fullerton, president of the Fullerton Rolling Mill Company, Philadelphia, and also president of the Altoona Iron Company, Altoona, Pa., died May 27, seventy-four years old.

Abram W. Stevens, a pioneer builder of threshing machines, died at Auburn, N. Y., May 12, eighty-five years old. He was born in Genoa, N. Y., opened a small shop and was building steam engines when twenty-one years old. He began building threshing machines in 1842 and continued the business there until 1878, when it was removed to Auburn and greatly extended under the firm name of A. W. Stevens & Co. He retired from active business five years ago.

A 2,000,000-gallon waterworks pumping engine, built by the Clapp & Jones Manufacturing Company in 1875 for the city of LaFayette, Ind., has been presented by that city to the department of Mechanical Engineering of Purdue University. The engine is a fine example of a duplex walking-beam pump, and in addition to its historical value it will supply water for hydraulic experiments.

Inquiry for Machinery.

(123) Names and addresses of manufacturers of machinery for insulating wire with cotton thread for electrical purposes.

Commercial Review.

NEW YORK, Saturday, June 2.

MACHINISTS' SUPPLIES.

The market is now in process of readjustment after the unnatural conditions of the past year. Manufacturers have begun to lay away a little stock. Prices are being gaged to see if in any cases they need to be lopped off to suit them to ordinarily prosperous times. There appears to be no possibility, at present, of any unpleasant surprise like a panic, since everyone's bills are paid and everyone has been making money and is upborne by the profits of 1899, even if these are not destined to be duplicated in 1900. The advent of a summer month palliates a dwindling volume of trade. If next fall's business bears a normal ratio to that of the spring it will be eminently satisfactory. Consumers, it is true, are buying rather less freely than of yore. Some of the largest jobbers have grown cautious, and are placing few important stock orders. The chief of one of the principal New York supply houses tells us that he is not buying anything at present, and we know of a prominent firm in Philadelphia where instructions with the purchasing agent are to restrict transactions as much as possible. This policy of hesitation is due in part at least to a desire to await developments in prices.

The prices of small tools are still well maintained. The goods carried by supply houses which are now offered at reductions are the rougher lines, like pipe and fittings, rather than the finer ones, such as files and twist drills. This is not to assert that no concessions have been made on the latter in special instances, but these are exceptional. It is claimed that locally the twist drill market is firmer than it was two or three months ago. The manufacturing side of the market has shown that it has the power and determination to maintain the financial status quo. Jobbers had stocks taken or outstanding on contracts made at old low prices and were disposed to put forth a special effort to sell drills to be furnished under these contracts while they lasted, even at a concession in price. Consequently there was some cutting in bids on large requisitions. Later, when the jobber ran out of certain sizes of drills and tried to supply the deficiency from the manufacturer at current prices, the latter refused to furnish them unless the jobber would agree not to do any more cutting, and the manufacturer carried his point.

Among the power transmitting machinery lines rope drives and friction clutches continue to be notable because of the growing demand for them relative to other classes of apparatus. The friction clutch business has been helped of late in a quarter where fairly early deliveries can be given, by the temporary hindrance of a prominent Western competitor, through labor troubles. But irrespective of this, friction clutches are growing in favor as they are becoming better understood. Wood pulleys are pronounced in steady demand by representatives of leading manufacturing concerns, who are maintaining prices well. The competition in this line has increased considerably since the expiration of a certain patent, and some of the newcomers in this market have been inclined to make low prices, but it is said that they have since grown more conservative. There is rumored to be some cutting going on in the Philadelphia market.

There is said to be a fine export demand for shafting and other steel products, which is reviving now that prices have declined sufficiently to allow it. This is regarded as of great importance to producers as it will materially aid them in disposing of their surplus output, which otherwise must soon be visible unless either domestic trade should revive or production should be curtailed. Mills are fairly busy on single time with old work, but are hustling for orders. Domestic buyers' needs are thought to be mighty, and in some cases pressing, but they are standing off in hopes of a further decline, which the mill man is determined shall not come about to any great extent, as he is disposed to restrict production rather than let stocks pile up. When prices on either the present or a lower basis appear permanent the buying movement at home is expected to resume.

CHICAGO MACHINERY MARKET.

The demand for boilers and engines may have fallen off somewhat during the past few weeks. Of this there is some doubt. The large factors to the market are a little uncertain about it. It seems as if business in sight is not quite so lively, but when inquiries and recent orders are reviewed there is developed a quite satisfactory total. New enterprises are not so common, perhaps, in electrical work, but very many street railway companies are planning and contracting for improvements and extensions. There is in prospect a large amount of business of that nature in the South and West. Manufacturers also are present in force. It is not so easy to sell a power outfit, for inquiries are slower than usual. The feeling exists among the prospective buyers that a delay may bring lower prices, and unless demands are urgent the disposition is to procrastinate in the hope of getting some concessions. The impression that prices may be reduced has its origin in the weakness of values in crude iron and steel. Boilers have sometimes slightly responded to this condition, but there is at least one prominent instance in which the prices of engines have been advanced during the past month for the special purpose of checking a demand that exceeds the ability of the producer to fill.

Gas and gasoline engines have a gaining demand from month to month. The Otto Gas Engine Works report business larger than a month or two ago. They have recently had quite a number of orders for shipment to Cape Nome, the sales including entire outfits for sand pumping. A number of carload orders of this description have recently been filled.

The E. P. Allis Company has sold to a Grand Rapids (Mich.) electric railway company a 1,200 horse-power engine. The Allis Company formerly turned out one engine a day, but now, on account of the much larger units, they are able to complete an engine only about every other day, this notwithstanding the greatly improved facilities for production.

Wickes Bros. have sold to the American Strawboard Company for installation in the buyer's plant at Lockport, Ill., a power outfit of 1,200 horse-power, consisting of Allis Corliss engine and vertical water-tube boilers. The University of Illinois, at Urbana, Ill., has just purchased an additional 300 horse-power boiler of the Babcock & Wilcox type, supplementing several already in operation at that institution. The Atlas Engine Works have sold a 300 horse-power steam plant for shipment to Buenos Ayres, the purchaser being a railway company. A sugar beet company at Dundee, Mich., is said to be in the market for a large power outfit. It is also reported that a new beet sugar plant will be erected at Shelby, Ind., by the Lake Agricultural Company.

CINCINNATI REPORT.

There is a marked difference in tone among those who have observed conditions among Cincinnati machine tool builders. We have good authority that while shops have orders for several months ahead there has been a decided falling off in new ones, and that men have been laid off in numerous cases. Yet the following report, made, as we believe, upon careful inquiry, shows that there is a good volume of optimistic report still current among leading manufacturers:

Conditions in Cincinnati from a manufacturing standpoint may be termed flourishing. It would naturally follow, then, that the demand is keeping up to a certain standard. Reports from the jobbing districts indicate that there has been no perceptible diminution in prices. In certain lines of tools there has been some decrease in both demand and price from a market standpoint, but if there is anything of this kind in machine tools and kindred articles an investigation among leading manufacturers failed to elicit any evidence of it.

President George Verity, of the American Rolling Mill Company, the new independent concern just being established at Middletown, Ohio, was in the city today discussing manufacturing conditions at the Business Men's Club, and gave it as his opinion that as soon as buyers realize that prices on steel have settled down to a stable basis business will increase per-

ceptibly. In his opinion the price of steel has about reached its lowest point. He anticipates a good early fall business. The mill and engine foundations of his concern are just being built in the new plant at Middletown. The building will be completed by August 1. The machinery has already been purchased and is ready for installation. This comes mostly from Pittsburgh. One of the large engines was purchased of the Hooven, Owens & Rentschler Company, of Hamilton, Ohio. As is generally known among the iron and steel men, this new plant is to furnish material for the American Steel Roofing Company at Cincinnati and other cities in which that company is interested. The over-product is to be put on the market.

One of the largest manufacturers of milling machinery in the Central West reports the business for May the best in any month except January for the last seven years. As to prices, there has been no discernible falling off. The Bullock Electric Manufacturing Company has enjoyed what they term their record breaker in the matter of sales of power equipment. During the month of May the sales amounted to $150,000, and the business was nearly all of a domestic character. This equipment for the most part comprised motors for driving machinery.

Greaves, Klusman & Co., machine tool manufacturers, one of the local concerns whose business is for the most part domestic, reports prices on finished product keeping up well and the demand good. Because of the chiefly domestic character of their business this speaks well for home conditions. Mr. Klusman, of the firm, reports that they have all they can do; that the payrolls have been increased recently, and that more machines have been put in, one a 30x30-inch by 10-foot planer and one 36x36-inch by 8 foot planer. It is the consensus of opinion of the larger manufacturers here that there will be no perceptible decrease in demand for the summer.

A number of foreign gentlemen have been in the city the past few days calling on the manufacturers and placing orders. Among these, two representatives of S. Hoffnug & Son, the large Australian buying house with headquarters in Melbourne, Brisbane and Sydney, purchased a lot of sugar and wood-working machinery. P. Hayman, representing an American importing company in London, visited Cincinnati in paying his first visit to this country. He is making a general tour of America to see what he may discover in the line of manufactured articles for which there is now, or might be worked up, a demand among the people of England. Mr. Hayman agrees that while English people always give their home manufacturers the preference when there is a choice, there are a great many manufactured goods, especially in the American machine tool market, not now manufactured by the English, and acknowledged leaders, which they buy here in preference to their own.

PITTSBURGH REPORT.

As the month of May drew to a close the market was not without indications of gradual recovery from its slump, but, like most other recoveries, this must be slow at best. The signs are fairly promising for a stronger market from now on, and all prospects of a further decline have grown less sharp. Consumers are again ordering somewhat and inquiries are coming in more like the old-fashioned way, before the late "fright" made its appearance. It is true that orders are not of large proportions, nor for future delivery, but they are large enough to keep plants going, and call for immediate delivery. The hand-to-mouth buying has been going on since the first of the year, and the same plan is being followed still.

It is hardly likely that the situation will change much until the prevailing prices for Bessemer and semi-finished products are lessened. Prices for finished material are as low as they can go under present prices for raw stuff, and the whole situation is with the Bessemer producers. There is some belief expressed that Bessemer will be brought down to $20 after July 1, and that finished material will be shaded down to meet the demand of the buyers, and still leave a nice profit. This will serve to place the market on a sound basis and keep things humming again.

The various plants throughout the Pittsburgh district are kept running regularly, although nearly all state they could take care of more work if necessary. Last week a new organization was perfected in this city by Messrs. Chas. C. Slocum, William L. Elkins, Chas. A. Otis, Jr., and others, to be known as the Keystone Car Wheel Company. A large plant will be erected within a few miles of this city, near Homestead, which will have a capacity of 300 car wheels a day. The main building will be 110x300 feet, and will be fitted up with the latest improved machinery for the making of car wheels.

The Union Steel Company, which was recently organized by Mr. W. H. Donner and others, of this city, has made a start on its new plant for the manufacture of wire rods, etc. It will be one of the finest plants of its kind in the country, and will contain machinery of the latest type and of the largest size. The Southwark Foundry and Machine Company, Philadelphia, will furnish several large compound condensing rolling mill engines; the Frank-Kneeland Machine Company, Pittsburgh, will install most of the rolling mill machinery; Shiffler Bridge Company (recently absorbed by the newly organized American Bridge Company) will erect all the buildings, which will be of steel construction.

MISCELLANEOUS PENNSYLVANIA NOTES.

Franklin Air Compressor Company, of Franklin, will begin the erection of its new shop very shortly, and push it to completion without delay. The location of this new factory in Franklin is looked upon with more than considerable favor by the inhabitants. Gen. Chas. Miller is president and Samuel G. Allen general manager.

Struthers, Wells & Co., of Warren, find the demand for their gas engines steadier and larger to-day than ever before. Attention has been given and money spent to bring the engines into the first class, and they are now selling in a very satisfactory manner. The shops have been rearranged to care for the gas engine end of the business, and extensions are probable in the near future.

H. B. Underwood & Co., Philadelphia, are busy manufacturers. They report a steady stream of inquiries for the special tools they build, and sales not a few. The fourth edition of their little book for engineers is in great demand. It is sent gratis, and contains in a handy form much valuable information.

Quotations.

NEW YORK, MONDAY MORNING,
June 4, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$20 50 @ $21 00
No. 2 X foundry	19 50 @ 20 00
No. 2 plain	17 50 @ 18 00
Alabama Irons:	
No. 1 foundry	22 00 @ 22 25
No. 2 foundry	21 00 @ 21 25
No. 3 foundry	20 00 @ 20 25
No. 1 soft	22 00 @ 22 25
No. 2 soft	21 00 @ 21 25
Foundry forge	19 25 @ 19 50

Bar Iron—Base sizes—The price on dock, 1.75 @ 1.80c. for good refined brands and irregular at 2.15c. to upward of 2.30c. for same from store. Cheaper refined iron is quotable at about .05c. less.

Tool Steel—Base sizes—Standard quality, 7 @ 8c., with a cheaper grade, hardly to be called "Standard," obtainable at 6½c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 2.45c., upward.

Cold Rolled Steel Shafting—Base sizes —From store, 3¾ @ 4c.

Copper—In carloads—Lake Superior ingot, 16½ @ 16⅝c.; electrolytic, 16 @ 16¼c.; casting, 16 @ 16⅛c.

Pig Tin—In 5 and 10-ton lots, 30c., f. o. b., New York.

Pig Lead—4c. in wholesale lots, carloads, .02½ @ .05c. extra.

Spelter—Prime Western, 4.50 @ 4.60c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; United States, 9⅜ @ 9½c.

Lard Oil—Prime City, 58c. in lots of one to five barrels.

The Paris Exposition—IV.

EDITORIAL CORRESPONDENCE.

It is nearly a month since the Exposition was formally opened to the public, and during that month many people have paid to see workmen preparing exhibits and to view the cloths that cover exhibits to protect them from flying dust and dirt. Much has been accomplished within the month, however, and it is beginning to be apparent that not only will there be much to see here that will be interesting and instructive, but that the buildings on the Champ de Mars and those on the avenue leading from the Champ-Elysées to the Invalides, called the Esplanade des Invalides, are going to be very beautiful. Naturally those who were at Chicago in 1893 are tempted to make comparisons, but comparisons are very difficult. The buildings at Chicago were of a different type. It might be said that they were majestic and imposing, while these are better characterized by the word beautiful. Current is beginning to be supplied for illumination, three of the large engines on the Champ de Mars having been in motion the evening of the 6th, when the first *fete de nuit* was given, and the Eiffel Tower and a goodly portion of the immense building extending in two lines from the tower to a distance of about 1,800 feet, where they are joined by the Palais de Electricie and the superb Chateau de Eau, were illuminated. The water did not flow over the Chateau de Eau, however, nor did the fountains play, although it is promised that this unique feature of the exhibition will be completed soon.

In fact it was announced on the 8th that all work of installation is to stop on the 12th, and that exhibits not in place and ready on that date will be excluded and the space assigned to them otherwise disposed of. It does not seem as though this order could be carried out very strictly, however, for exhibitors are in the hands of those who move and unload freight cars, and no one can possibly be more anxious to see exhibits completely installed and ready for inspection than the exhibitors themselves. They unanimously declare their inability to get things to go ahead as they should. A loophole is left in the official order, however, which makes an exception in cases of delay caused by "*force majeure*" recognized by the authorities, or by special authorization. This "*force majeure*" will undoubtedly assume the form of simple inability to get cars into the buildings, get them unloaded and out again so as to admit others, but the order may produce a stimulating effect considered simply as a bluff. Certain it is, at any rate, that work has been proceeding rapidly in the American machinery building at Vincennes, and the date now fixed for the formal opening of this exhibit is the 15th inst., by which time it is expected that most, though probably not quite all, of the machinery will be in place, and that some of it will be ready to run.

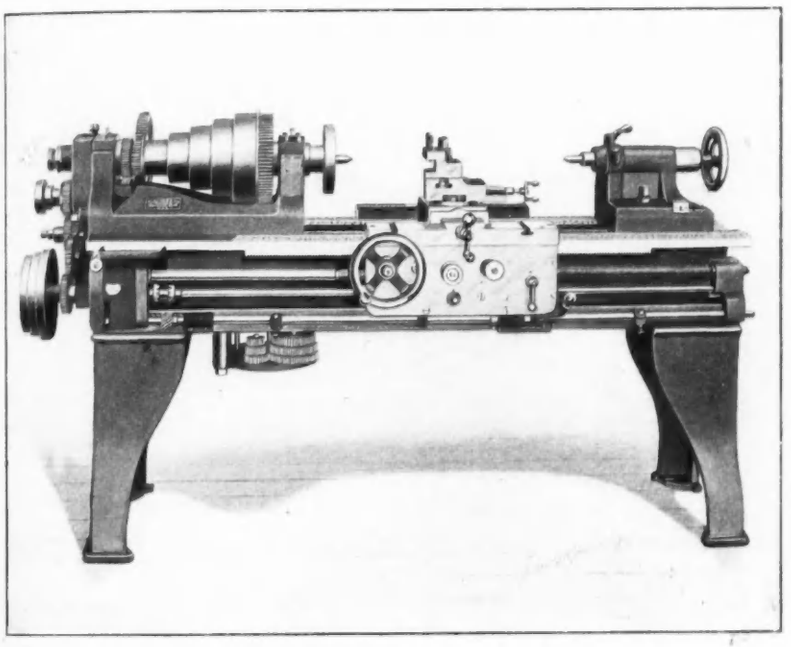


FIG. 7. 17-INCH FLATHER LATHE SHOWN AT PARIS.

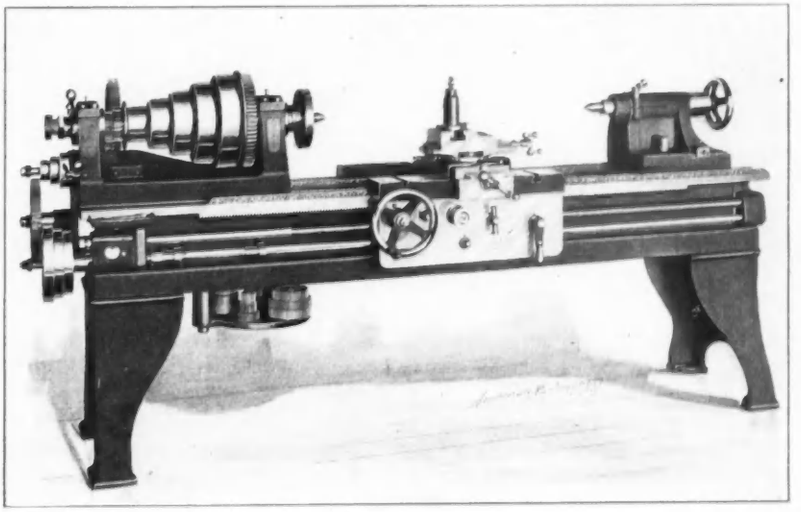


FIG. 8. 20-INCH FLATHER LATHE SHOWN AT PARIS.

THE WORTHINGTON PUMPS.

In a former letter I spoke of the alleged fact that the Worthington pumps were not ready to supply water on the opening day. Of course, where scarcely anything whatever was completely ready it is not particularly discreditable to be with the majority, but I have met Mr. Bagshawe, the manager of the French Worthington Company, and he has demonstrated to me that they did have one pumping engine of 500 litres (131 American gallons) per second capacity not only ready to run, but that it did run on that day, and was in motion under steam two days before the date of the opening. This one pump, they knew, would be more than there would be any use for, and so did not make a special effort to have any additional ones of the group of four like engines running. He gave me many interesting particulars of the efforts necessary to have the station ready in time. It was two months after the date set therefor before they could get possession of the site for the building. The engines were built at Lille, and when a carload, or a number of carloads, of parts were ready for shipment a man went to Lille, got the numbers of those cars and accompanied them all the way to the Champ de Mars, in some cases paying liberally to get the cars coupled on to trains that would otherwise not have taken them. In one case he spent eight days on the journey. Then when this machinery arrived on the ground the means for delivering it in place were not yet ready made, and 5 francs, or practically $1, per ton

was paid extra for getting it in place. By such extraordinary efforts and expenditure the Worthington people have been prepared to meet all demands, and very naturally think they deserve the credit for being ready. It is worth noting, perhaps, that besides these and numerous other pumps installed especially for exhibition purposes, there are now seventeen Worthington pumps running in the Eiffel Tower. Some of them were installed when the tower was built and are now in the same service as in 1889. The others have been installed later to take the place of fly-wheel pumps, all of these latter that were originally installed having been taken out.

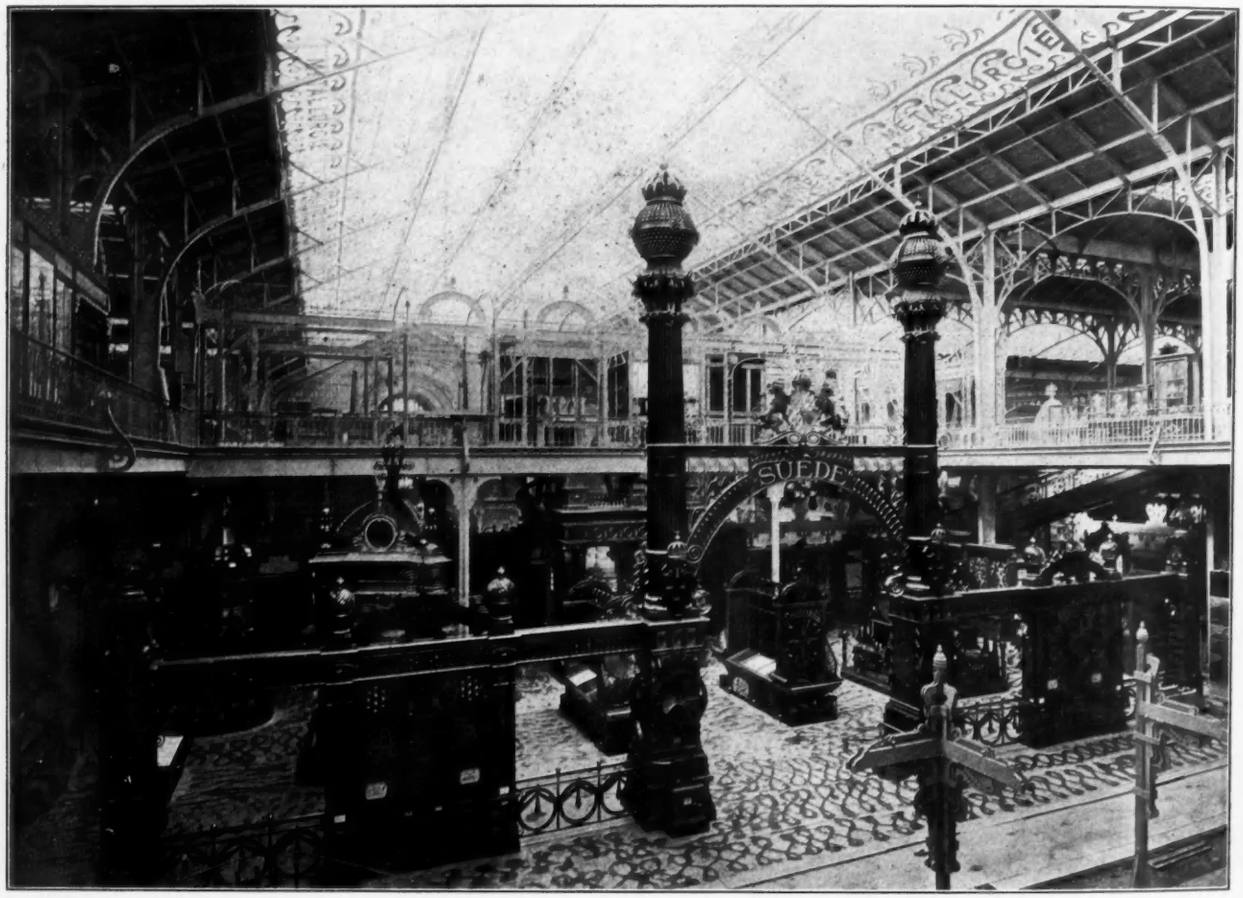


FIG. 9. GENERAL VIEW OF SWEDISH IRON AND STEEL EXHIBIT AT PARIS.

WOODWORKING MACHINERY.

American woodworking machinery is going to form an important portion of the exhibits of machinery, and the export of this class of American machinery continues to go on at a satisfactory rate. An American who has had a good deal to do with introducing it here told me of an interesting case coming within his own experience. A car works that had from time to time purchased a number of large planing machines of English make wanted another machine, and he offered them one of American make. It cost 12 per cent. more than the English machine, however, and they thought that as the English machines had always been satisfactory they would place their order where they could get the machine at lowest cost. The American told them that his machine would do 12 per cent. more work than the English, and said if they would try it and it did not do 12 per cent. more he would take it out without expense to them. As 12 per cent. more work from a machine costing only 12 per cent. more "figures up big," they accepted his offer, and the machine was installed for trial. It did exactly three times the work, and in fact the feeds were reduced, because, as the American expressed it, the men who carried stuff to the machine and carried it away again "could not move their wooden shoes around lively enough to keep up with it."

SOME EUROPEAN SHOPS' WAYS.

The same man told me of an amusing incident that occurred with one of the Cincinnati Shaper Company's machines that he had sold. They set it up and fastened it securely to the floor beams without seeing to it that there was space enough behind between the machine and a brick wall to allow the ram to go clear back on its longest stroke. It happened when they got it ready to run that it was set for the longest stroke, and the belt was at the same time placed for the highest speed. The man threw over the shipper to see it go; the ram moved a few inches forward and then shot back like a battering ram, and punched a hole through the brick wall. The man, apparently thinking it would inevitably proceed to demolish the rest of the shop, ran away.

Of course, there are many good and well managed shops here, as our readers know, but, on the other hand, there are many in which very queer things can happen. For instance, a large boring and turning mill was sold. It had movable housings to extend its swing for emergency jobs, and this feature had, of course, been paid for extra. The mill did not give satisfaction, and when a representative of its builders went to see it he found they were attempting to run it literally without having done one thing to it except to unpack it and set it up. None of the dope with which it had been covered had been removed. None of the spots of rust that it had acquired on some of its working surfaces during the voyage had been removed. Important bearings had not been oiled, and a pillar of the building stood behind the rail, where it prevented the housings from being run back.

SOME FLATHER LATHES.

As Mark Flather himself expresses it, a lathe is a lathe after all, and there is little opportunity for startling new features in their construction, or for selling them if they embody too much that is unusual. His firm (Flather & Co., of Nashua, N.

H.) shows some new features, however, on some of its lathes exhibited here, and one of these lathes is shown at Fig. 7. It is 17 inches swing, 6-foot bed, and has an automatic stop for the carriage which operates in either direction, and the carriage can be reversed by hand either when feeding or screw cutting from the apron. Both this automatic stopping and the hand reversing are effected by the same rod in an ingenious manner. The reverse motion is provided for by the use of a double-ended clutch playing between gears driven in opposite directions as usual, but no bevel gears are used, all of them being spur gears. The clutch is moved by the lever seen in front below the headstock, and this lever is moved by the lower rod that extends along the bed below the carriage apron. When the carriage is to be stopped automatically, either in feeding or screw cutting, a collar is set upon this rod at the desired point, and when the carriage contacts with this it shoves the rod endwise and releases the clutch under the head, after which the carriage is run back by hand, or, if screw cutting, by moving the rod still further by hand to make it engage the reversing clutch. This further movement of the rod is made, not by shoving it bodily endwise, but by turning it by means of the hand lever seen below the carriage at the right, rotary motion of the rod producing also endwise motion of the same by means of the spiral pinion seen on the rod below the headstock, which engages with a short spiral rack fastened to the front of the bed. Mr. Flather shows specimens of external and internal thread-cutting done on this lathe where the tool has at each cut run up to precisely the same point and stopped there, producing an annular groove of exactly the same section as the thread itself; and this, as we all know, is of considerable importance, especially in internal threading, where room is often very much restricted. This is, of course, not the first lathe to do this, but it is a modern attainment, conducing very much to the neatest lathe work without excessive cost.

FIG. 10. EXHIBIT OF SODERFORS IRON WORKS AT PARIS.

Other features of the machine are made clear by the photograph. Mr. Flather claims that his firm was the first to regularly make for the market hollow spindle lathes. They first did this in 1871, being led thereto by the demands of customers who had seen a hollow spindle lathe built for their own use with a view especially to cutting off stock with it. They were the first also to connect the lead-screw and feed-rod by gearing, using a clutch to give changes to speed or to engage and disengage. Fig. 8 shows their latest design of plain lathe as exhibited here, in which design the carriage has been much deepened to give it strength, the cross-feed slide made much wider than formerly, both spindles much enlarged, the lead-screw made larger and the cut in the footstock by which the tail spindle is clamped changed from the rear to the front. A 26-inch lathe of this type shown at Vincennes has a bearing for the cross-slide 11 inches wide and a lead-screw 2¼ inches diameter, Acme thread. Mr. Flather says he believes that the criticism often brought against our lathes by European users, that the lead-screws are too light, is a just criticism, and he proposes to profit by it.

A shaper shown by the company looks outwardly like an ordinary pillar shaper, but really has both the slotted lever and the Whitworth quick-return motions combined, and the lever is attached to the ram by a fixed pivot and is slotted at its lower extremity, where it is ordinarily pivoted to the frame. This, Mr. Flather states, contributes to uniformity of motion during the cutting stroke, and besides he says that the weight of the lever hanging on the ram helps to steady it, and is an advantage. This shaper also has a supple-

mentary support for the table, in the form of a bracket which is fastened to the cross-rail and always gives a support directly under the tool.

A CURIOSITY AMONG MACHINE TOOLS.

Among the French tools exhibited on the Champ de Mars is a boring and turning mill that is specially interesting. It is as exact a copy as its north of France builder could make of a Bullard mill; but he was unfortunate in the selection of the particular Bullard mill that he used as a model, and this has led to a curious result. A number of years ago the Bullard Machine Tool Company, of Bridgeport, built some boring and turning mills for a concern that had a steam engine that was a radical departure from the standard reciprocating engine. They had also sufficient faith in the engine and sufficient available capital to cause them to build and expensively equip a shop for its systematic manufacture. These boring and turning mills were especially for facing off rings that were thicker at the outside edge than at the inside edge; so that, in order to do this work, the tool-bar had to be given an upward or downward motion at just the right rate as the saddle moved along on the rail. This was accomplished by clamping, at the top of the cross-rail, brackets that supported a guide set at the proper inclination, and a block that was fitted to slide upon this guide was attached to the rear side of the tool-bar, so that, as the saddle moved upon the rail, the tool-bar would of course move vertically at a rate proportioned to the inclination of the guide-bar. It was, in short, virtually a Slate taper attachment of special form applied to this purpose. Fixed in this way there was no vertical adjustment for the tool by hand, such as is necessary for setting the tool to a cut, etc., and so, to provide such a means of adjustment, the tool-bar was bored out longitudinally and a cylindrical piece fitted into it and made to slide within the tool-bar by means of a traversing screw with a spur gear at the top connecting with a shaft running down the outside of the tool-bar to a pair of miter gears and a short horizontal shaft squared for a crank handle.

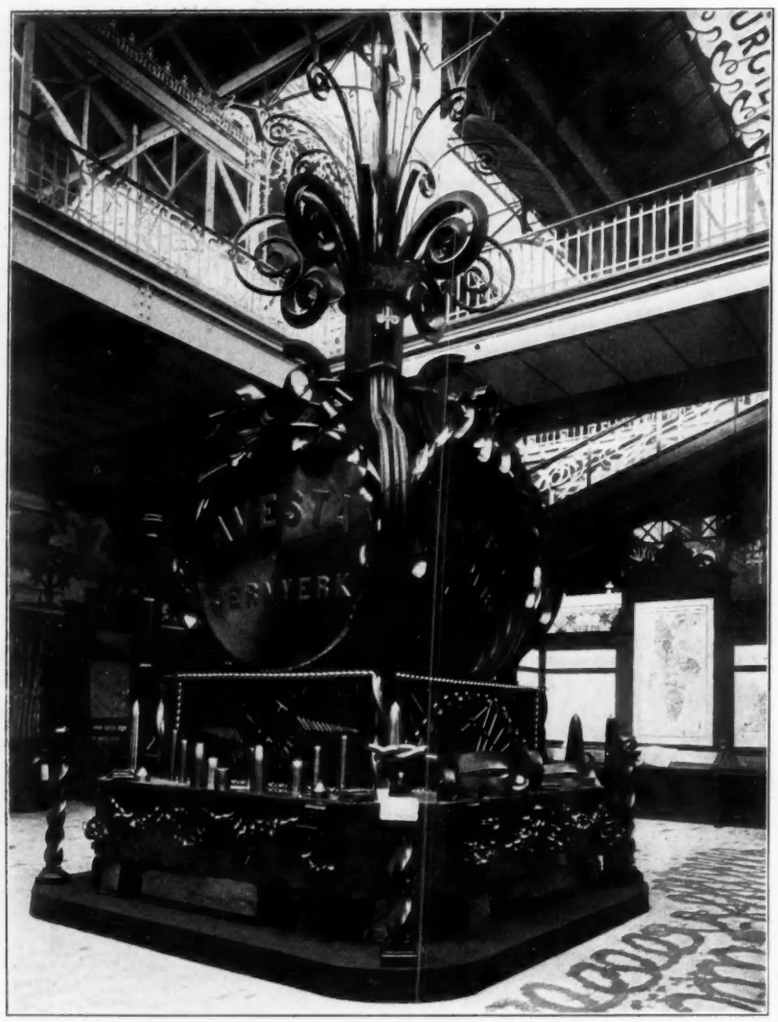


FIG. 11. A SWEDISH STEEL EXHIBIT AT PARIS.

Very few of the engines referred to were ever built, and the mills found their way back into the hands of their builders. One of them was finally sold to Adolphe Janssens, the tool dealer, of Paris, the guide-bar and brackets being taken off, thus making the regular movement of the tool-bar through its bearings available and making the special vertical adjustment useless. The latter was not removed, however, since it would do no harm and its removal would have involved the making of a new tool-bar. The reason for all this was explained by Mr. Bullard and understood at the time, but the man who concluded to make a copy of the machine had no explanation of the matter, and consequently his copy, as it stands to-day in the Exposition, has two distinct means of adjusting the tool vertically, one by moving the tool-bar, the other by moving the sliding piece within the bar, the latter feature being of course utterly useless, and therefore worse than useless—reproduced simply because it was on the particular machine copied and manifestly without the matter having been given one iota of intelligent consideration.

THE IRON AND STEEL EXHIBIT OF SWEDEN.

The iron and steel exhibit of Sweden is generally conceded to be one of the finest and most interesting things to be seen here, and constitutes an excellent example of what may be done in this line by concerted action under competent direction. The exhibit is, to begin with, composed of specimens which are in themselves interesting and instructive, and then these are arranged in the most artistic manner, so as to not only make each firm's exhibit attractive by itself, but so as to make the entire space, taken together, exceedingly artistic and impressive. Prof. Axel Wahlberg, Director of the Testing Institution of the Royal Technical High School at Stockholm, has general charge of the exhibit, the exhibits having been arranged by the several firms participating, after a general plan designed to a harmonious ensemble. It is difficult to get a satisfactory photograph of the exhibit, but I send one (Fig. 9) that gives some idea of the general appearance, while Figs. 10, 11, 12 and 13 show some of the most interesting individual exhibits. The photos give, however, only a faint idea of the beautiful effects produced by the combinations of finished and black surfaces and, in some cases, by utilizing the colors of oxidation produced by heat; commonly known as "temper colors." In the exhibit of Söderfors, Fig. 10, the most prominent objects are round bars of steel, about 2 inches diameter, tied in knots cold: pieces of square bars bent double cold, and ingots that have been split open to show the segregation. The castings seen are of steel, including the anvils, which are castings with hardened faces.

In the exhibit marked Avesta Jernverk, Fig. 11, the largest square bars seen at the right, bent double are 125mm., or slightly over 5 inches, square. They have been finished and then bent cold, without show-

ing a sign of crack or flaw. At the inner turn of the bend the metal has been pushed out so that the width is 180mm., or 7⅛ inches, while at the back of the bend the stretching has reduced the width to 85mm., or 3⅜ inches, the curves joining the two corners on each side (i. e., transversely of the bar at the bend) being beautifully regular and showing absolute homogeneity. The festoons at the sides of the base are made of strips of steel about ⅜ inch thick by 1½ inches wide, finished and then twisted.

The Olofstrom exhibit, Fig. 12, is an especially neat one. The objects on either side are torpedo heads, made of one piece of steel, commencing with a flat disk, and in fact, as the notice in French states, all the specimens shown are of one piece of metal without seam or weld, including the goblet and drinking horn in the center.

The exhibit of the Fagersta Iron Works, Fig. 13, is of special interest, not only on account of the interesting specimens shown, but also because their general superintendent, to judge by what is to be seen here of his work and by what Prof. Wahlberg tells me, is a remarkable man. There is shown here a system of testing metals by steel balls, devised by this man, whose name is J. A. Brinell, which system is new and seems likely to be very useful for practical testing, the more so since one simple machine capable of exerting only a moderate pressure serves to make tests determining the hardness, ductility, the yield point, extension, ultimate strength and homogeneity of a specimen. Mr. Brinell uses a steel ball, 10mm. in diameter, which he presses into the specimen by a known pressure. The area of the surface of the indentation is then used as the basis from which to determine hardness, while the other properties named are determined by pressing the ball into the specimen at a standard distance from the edge, so that it swells the metal out at one side; a shadow which appears on this swelled surface indicating the yield point, the amount of projection, the ductility, the point at which a slight crack appears, the ultimate strength, etc. The balls used for this purpose select themselves from among others by their degree of elasticity. When finished, they drop at an angle upon the surface of a hardened steel block and rebound. They rise on the rebound to varying hights, depending upon their own hardness, and various openings are so placed as to receive them at the different hights and thus separate into different lots those of the same degree of hardness. It is said that by this means a remarkable degree of uniformity is secured. Of course the tests made by these balls are more or less empirical, but they are comparable, are at least accurate enough for most practical purposes, are very quickly made, and with comparatively simple and inexpensive apparatus.

Among the other things experimented upon by Mr. Brinell are the different hardening efficiencies of various quenching baths for steel of various analyses. Charts exhibited by him show that a solution of soda in water is about as efficient as any of the commonly used baths and at least as good as any other; brine, however, being a good second. In testing the hardening capacities of steel with various carbon contents, he has discovered the curious fact, hitherto unrecorded I am told, that from the smallest carbon contents up to a carbon percentage of 0.45 the hardening capacity of steel regularly increases with each increment of carbon contents, but that from 0.45 per cent. up to 0.95 per cent. there is no increase nor, on the other hand, any falling off, but beyond 0.95 per cent. C. the hardening capacity begins to fall off; so that, according to his experiments, steel may vary from 0.45 per cent. C. to 0.95 per cent. C. and have precisely the same hardening capacities.

This system of testing is comparatively new and there is much to be learned about it yet, but it seems likely to be one of the things that will exert an important influence upon metallurgy and allied industries.

Among other things to be seen in this exhibit are some tubes of mild steel that are about 5 feet long, 9mm. (about 11-32 inch) diameter, and only .08mm., or slightly over .003 inch, thick, yet they seem to be perfect tubes, and a surprise is in store for those who are told by Prof. Wahlberg to lift them and to look out, as they are heavy. Most people start to lift them through the roof. For the common tubes produced by these works, Prof. Wahlberg says they cast cylindrical ingots, let them cool for a certain time and then pour out the still liquid central portion and roll and draw out the shell thus formed. For the best tubes there is some boring done, but it is found not to be necessary to bore the ingots for any but the finest tubes. The three strands seen festooned about the tops of the cases in Fig. 13 are all parts of one drawn steel tube, about ¼ inch outside, ⅛ inch inside diameter and 50.6 meters, or 166 feet, long. The two ends are brought close together, and one can, if he chooses and has

FIG. 12. EXHIBIT OF STEEL AT PARIS.

strong lungs, prove that the two ends belong to the same tube by blowing in one end and keeping it up until results are felt at the other.

The exact date of the beginnings of one of the Swedish firms that exhibits here, the Stora Kopparbergs Berslags Aktiebolag, is lost in the mists of antiquity. It is known to have been founded between the years 1200 and 1250, however, and so they call it 1225, at about which date they commenced to mine and manufacture copper. They have a charter granted by the king of Sweden and Norway, dated February 24, 1347, and they own a vast domain granted to the company many hundreds of years ago, which I do not know the extent of; but some idea of it may be obtained from the statement made by the company, that its forests from which its wood products are taken have an area of 850,000 acres; that there are water courses in these forests extending for 1,700 miles, and that the waterfalls on the company's property amount to more than 150,000 horse-power. From one of its mines, which has been worked for 700 years, 500,000 tons of copper, 15.5 tons of silver and 1.2 tons of gold have been taken, the whole representing a value of about $277,000,000. King Gustavus Adolphus the Great gave to the mine the honorary name of "The Country's Treasury," although it would seem to a man up a tree as though it were, more properly speaking, the Stora Kopparbergs Bergslags Aktiebolag's treasury. This company exhibits some remarkable specimens of welding, one of them being a cross-section of a bar, 6 inches square, composed of 100 square bars of mild and hard steel welded together, and another similar section which, after being cut out, has been heated and rolled out to a plate 11½ inches square, without disturbing a weld. The cross-sectional surfaces are finished and etched to show the different pieces and the welds. They also show a lathe tool with which 833 kilograms, or 1,832 pounds, of chips had been removed from hard cast iron since it had been ground, and another tool with which 970 kilograms, or 2,134 pounds, of chips had been taken from Siemens-Martin steel (carbon 0.40 per cent) since the last grinding. Both tools look capable of more work without grinding. The rate at which the chips were removed is not given, and that is very important, as we all know; but when I inquired about that they said the cuts were taken at the "ordinary rates."

F. J. M.

Paris, May 11.

FIG. 13. AN EXHIBIT OF STEEL.

A System of Cutting Bevel Gears With Rotary Cutters.*

BY HERBERT INNES JACQUES.

Bevel teeth cut by rotary cutters, although not so accurate as those done on machines of the planing type, yet, within certain limits, approximate to a correct shape of tooth, and are found to work out sufficiently near for general purposes. The system, moreover, possesses the advantage that for small shops where bevel wheels are required in too few a number to warrant the putting down of a gear planer, a machine may be used which will cut either spur, bevel or worm teeth as required. The manufacture of these gear-cutting machines has now reached a high standard of perfection, both in the design of the various motions which make up the machine, many of which are the subject matter of patents, and in the workmanship and materials used in their construction. Yet, so far as can be ascertained, none of the descriptive circulars issued by the makers of these machines, nor any of the text books on the subject of gearing, give to the users more explicit instructions for cutting bevel gears than may be summarized under the comprehensive head of "guess and trial." What is probably the most up-to-date book on the subject, viz.: that issued by the Brown & Sharpe Manufacturing Company, writes as follows: "We cannot readily tell how much out of center to set the cutter until we have cut and tried, because the same part of a cutter does not cut to the pitch-line at both ends of a tooth. As a trial distance . . ." And again: "After a little practice a workman can set his blank the trial distance out of center, and take his first cuts, without any central cuts at all; . . ." and further: "If now the thickness of the small end is in the same proportion to the large end as $O c'$ is to $O c$, Fig. 23, we can at once adjust to trim the tooth to the right thickness. But if we find that the large end is still going to be too thick when the small end is right, the out of center must be increased."

This practically resolves itself into each user making for himself, from his failures, a reference book, which, as a rule, will be jealously guarded, its value being directly proportional to the amount of time spent in obtaining the information. It may therefore be of interest, and probably value, to briefly describe a method devised by

*Copyright 1900, by Herbert Innes Jacques.

Messrs. I. Humpage and H. I. Jacques, of Luckwell Works, Ashton Gate, Bristol, England, by means of which bevel wheels may be cut with, it is believed, the nearest approach to accuracy obtainable with rotary cutters, the data and figures relating to any wheel being all obtainable beforehand from the drawings and calculations relating to the gear required to be cut. No guess and trial is therefore required, and the one side of the wheel can be cut all around without testing the accuracy by cutting a complete tooth, as is generally considered to be necessary.

The machine used was a 36-inch Brainard gear cutter, a well-known standard type of machine, the principal features of which are:

(1) A knee or bracket carrying the cutter slides, etc., which can be adjusted vertically.

(2) A cross slide on this knee by means of which the upper cutter slide and carriage

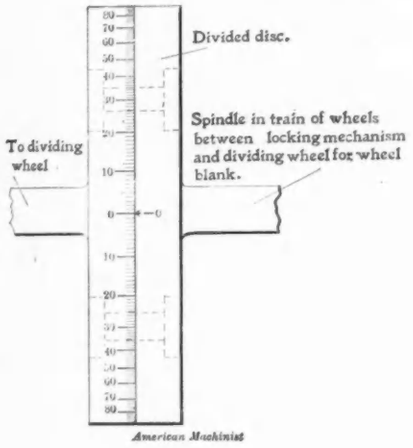

Divided disc.
Spindle in train of wheels between locking mechanism and dividing wheel for wheel blank.
To dividing wheel
American Machinist

Fig. 1

DIVIDED DISK FOR ROTATING BLANK INDEPENDENTLY OF DIVIDING MECHANISM.

can be bodily moved in a line with the machine axis.

(3) An elevating quadrant marked in degrees, to obtain the cutting angle.

(4) A pivoted upper slide secured by locking bolts, by means of which the cutter and its slide can be set over angularly on either side of the center line of the machine axis.

(5) A divided disk, Fig. 1, indicated in degrees and secured by locking bolts, by means of which the wheel blank may be rotated independently of the dividing mechanism, which mechanism is so arranged that the disk makes one complete revolution for each tooth cut, irrespective of the number of teeth to be cut.

Other standard machines contain these features in slightly different forms, and the system described may be modified according to the type of machine used.

Fig. 2 shows the outline arrangement of the gear-cutting machine, with the required position of the slides and other parts for cutting a bevel gear.

Fig. 3 shows the projection of a bevel wheel with the corresponding spur pitch circles laid off, as shown in the Brown & Sharpe Manufacturing Company's book.

Previous to fixing the blank in the machine, a line showing the depth of cut, both at the inside and outside of the blank, should be marked on. It is necessary that the knee K and the slide H should be adjusted in such a position that the projection of the line of the back of the tooth (which in Fig. 3 would be shown as a prolongation of the line O_2C) cuts through the center of the pivot F, which is referred

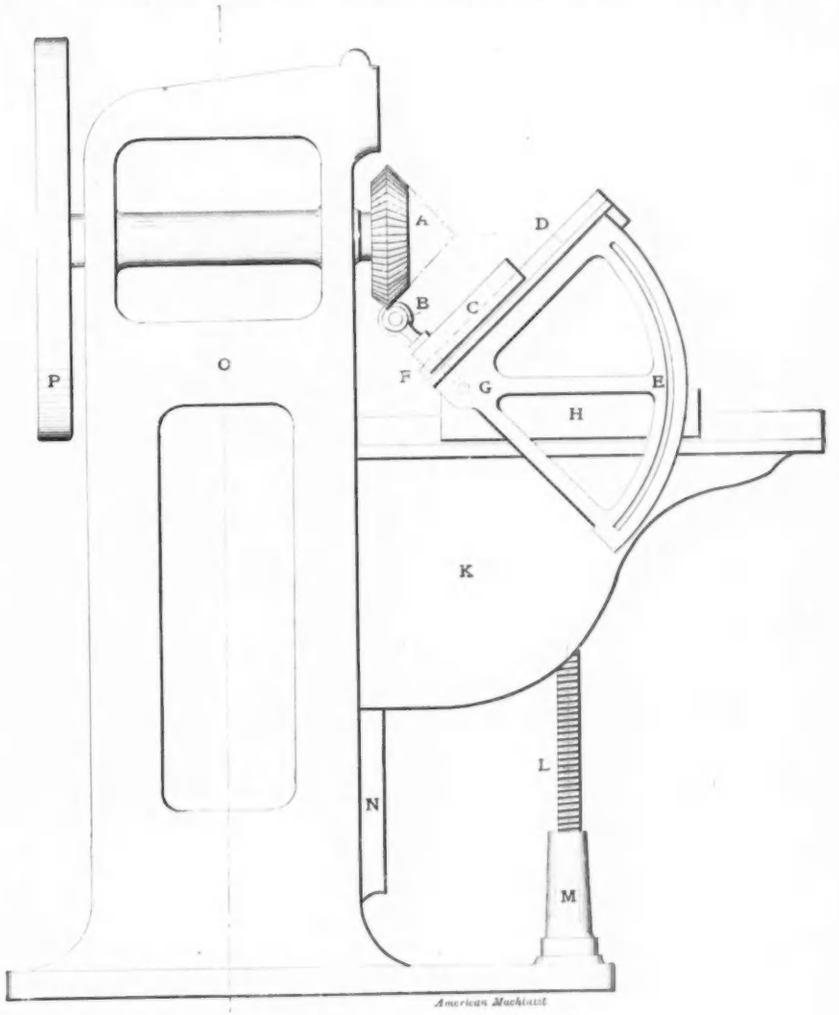


Fig. 2

GENERAL ARRANGEMENT OF MACHINE ADJUSTED FOR CUTTING BEVEL GEARS.

to in paragraph (4), when the cutter is set to the full depth of the tooth. The importance of this point lies in the fact that, when so adjusted, the cutter and its slide can be set over angularly by swinging it on its pivot F, without altering the width of the space cut on the outside pitch-line of the wheel. The quadrant having been previously set to the correct cutting angle, the depth of cut at the outside of the blank will be correct if the blank is turned up with proper face angle.

In Fig. 4 is shown a view (not to scale) of one tooth of a gear cutter. On this tooth is marked a pitch-line $c\,d$ which is obtained by setting off the depth of space below the pitch-line at the outside of the blank. The pitch-line $a\,b$ is similarly obtained from the inside depth of space, this depth being either measured from the drawing or obtained by calculation, as it varies according to the length of face of the tooth. In this system of cutting, each face of the tooth is cut on the center line of the machine, and the cutter must in consequence be set out of center to such an extent that the point c on the cutter coincides with the center finger indicator A of the machine, which for this purpose is ground half away at the point. It will readily be seen that though the point c, which is the true pitch-line of the cutter, will be on the center line of the machine when it is on the pitch circle at the outside of the blank, yet the corresponding point a for the pitch circle at the inside of the blank will be on one side of the center line when the cutter has returned to this point of the blank; consequently the cutter and its carriage must be set over angularly in order that the pitch-line of the cutter may correspond with the cone pitch-line of the blank at every point of its travel

through the blank. The amount of this set-over may be determined as follows: Take the width of the cutter at *c d* and *a b* with a micrometer caliper, and half the difference between these two dimensions will be the perpendicular of a triangle the base of which is the length of face of the gear tooth.

The formula for the required angle of set over will then be:

$$\text{tan. angle} = \frac{\frac{1}{2}(cd - ab)}{l.}$$

For example, if $c\,d = .258$

$a\,b = .210$

Difference $= .048$

If $l = 1''$ the tangent of the required angle will be .024, or the angle will be 1° 20′.

The machine is now set for cutting one side of the tooth, and the blank can be cut around for the required number of teeth. To cut the other side of the tooth the cutter must be set out of center on the opposite side, so that the point *d* coincides with the center finger indicator of the machine; the table must be set over to the same angle on the other side of the center, and the locking bolts of the divided disk, mentioned in paragraph (5), having been slackened, the half of the disk must be moved around half a revolution and the bolts tightened up again. This will give an exact half pitch division of the wheel blank, and the adjustments of the machine having been correctly made, the tooth will be found to approximate to a true shape.

In common with all teeth cut with rotary cutters, it will, however, be found that the teeth at the inner side have not enough rounding above the pitch line. This is most noticeable with pinions having very flat bevels and long faces. When wheels of which the faces are short relatively to the cone lines are cut, the teeth will be found to be almost correct, and in crown wheels there is practically no difference between teeth cut with rotary cutters and those planed to templates.

In order to adapt the machine to the cutting of bevel wheels on this system, several alterations were found to be necessary, which, as they may also occur in other machines, are briefly described.

In the first place, as it is necessary for the cutter to just pass over the center line of the pivot *F*, either the end of the feed nut on the under side of the cutter carriage or the end of the recess in which this nut works must be cut away, as no provision is made in the machine for the cutter to have so long a travel in this direction. Also, when cutting crown wheels, it was found necessary for the same reason, viz., the travel of the cutter past the center line of the pivot, to cut away about ½ inch of the end of the cutter carriage, as it fouled the top face of the knee *K*.

In cutting crown wheels, unless cutters of larger diameter than standard are used, the upper part of the cap of the main bearing of the cutter mandrel and the collar of the mandrel itself will foul the outside of the wheel blank, and it is necessary to cut this away. This is, however, a defect in the machine itself, apart from this system of cutting.

In order to set the slides and the pivot in their correct positions relative to the wheel blank, a device such as shown in Fig. 5 may be used. This locates the position with ease and accuracy, and by using three or four fingers *D* of different lengths all angles of bevels can be dealt with.

The scale marked on the segment indicating the angular set over of the cutter carriage is marked in degrees only. This is not sufficiently exact for the purpose required. The indications should be as fine

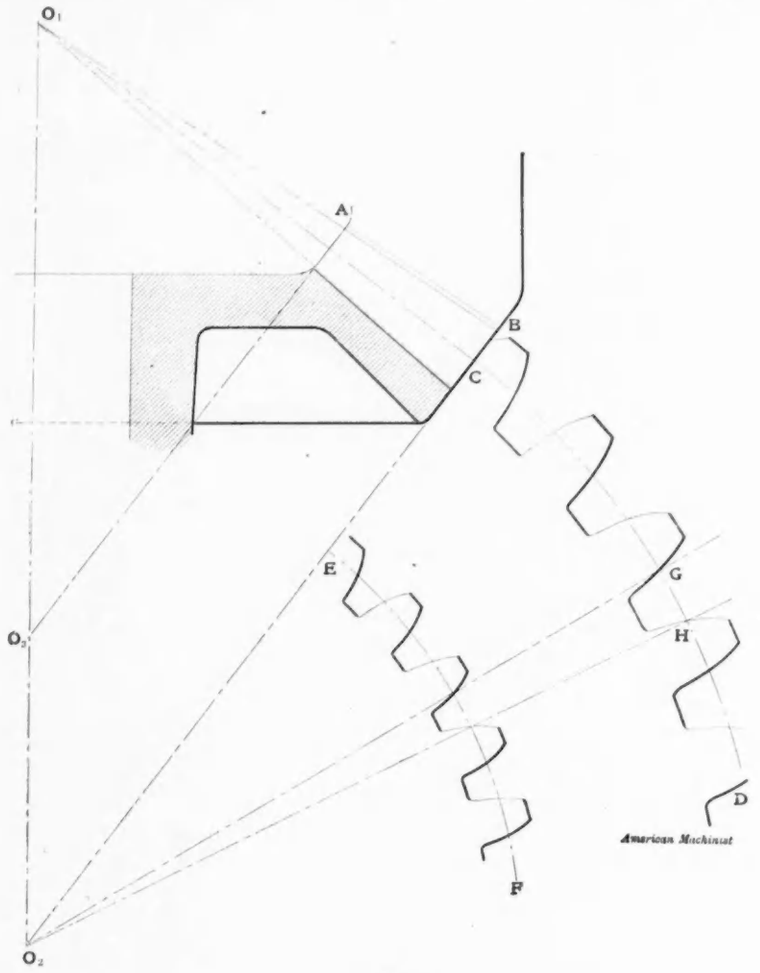


Fig. 3

PROJECTION AND DEVELOPMENT OF A BEVEL GEAR.

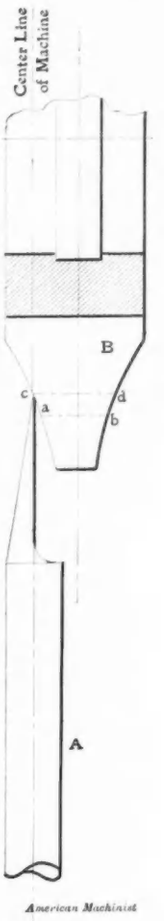


Fig. 4

TOOTH OF CUTTER, SHOWING METHOD OF ADJUSTMENT.

as divisions of 5 minutes, or preferably, some form of vernier should be used to give the exact angle as obtained by calculation.

In order to set the cutter out of center to the requisite amount it is preferable to use a screwed mandrel provided with collars and lock nuts. A very fine adjustment can then be made, and if the center indicator of the machine be half ground away, as shown in Fig. 4, there is no difficulty whatever in setting the cutter to the exact pitch line.

As regards standard cutters for bevel wheels, these, as now made, are, as a rule, too thick on the pitch line, and when cutting teeth with long faces, when the blank is set around and the adjustments made, it is sometimes found that the cutter will cut into the opposite side of the tooth when entering the blank in addition to that on which it should cut. To remedy this the cutters should be made as thin as possible, subject, of course, to their completing the whole width of cut at the outside of the blank in the two settings. This would also be an advantage in that the amount of metal removed would be more equally divided between the two cuts, and the amount of feed could be proportionately increased.

It would also be an improvement and save some short space of time, if the pitch line of the cutter were marked on the side of one or more teeth of same, following this around the relieved portion, so that the line would be unaffected by the grinding back of the face.

"Give References."

The recent articles on "The Salary Expected" were undoubtedly interesting, but something might also be said about "Give References." A good reference will say of a fellow that he is industrious, sober, intelligent (this refers to the extent of his book education) and able. Ability as applied, for instance, to a foreman, means, first, the man's own skill as a workman; then it has to do with his skill in handling men, in systematizing work and in seeing it profitably put through the shop. To these qualifications must be added energy. The fellow who can't hustle and also plan and investigate, so that he will be able to do better to-morrow than to-day, will soon be left.

It is natural enough, when advertising for a man, to ask for references. I knew a superintendent who had great confidence in references, and when advertising for a foreman for the machine shop he required the applicant to furnish four references. Just think of requiring a man to have worked in four different places with a good record in each. After considerable correspondence they succeeded in getting a man that seemed to suit. I was working there as a draftsman at the time, and I had a chance to see how things went. The man started, and he certainly was an old-timer. Slow but sure, he had to have a gang boss over every ten or fifteen men, and he walked around as a kind of foreman of foremen. He had the references, but he was an expensive experiment.

An incompetent foreman is always pretty expensive. I was visiting a shop in a certain city not long ago, and as the superintendent showed me through, I had a chance to see the run of things. He told me he had a splendid foreman; had been with them ever since he served his time; they paid him a good salary, and he was worth it. The shop had a hundred men, and I asked the superintendent to let me run his shop for 20 per cent. of what I could save over the existing practice. He said that he had no difficulty in getting out his orders, and smiled good naturedly. He was like the foreman: had been too long in the place. H. A. H.

Sixty-three automobiles competed in a recent 1,000-mile trial in England. "The Engineer," in summarizing the results of the trial, says that "there is not at present in immediate view a formidable rival to the internal-combustion engine for motor-car purposes." A satisfactory speed-varying gear is named as the chief feature now lacking.

Drawing Office System of The Bullock Electric Manufacturing Company.

BY W. H. WARREN.

In this article it is intended to deal more with the office system than with other considerations, but a few words about the office itself may not come amiss.

SOME FEATURES OF THE ROOM AND ITS FURNISHINGS.

The office is a room 15x60 feet, situated in the southwest corner, top floor, of the administration building. The room is well lighted by windows on the south and west, and artificially by six enclosed arc lamps and also by incandescent lamps at each drawing board. The blueprinting is also done in this room. The frames for this purpose, of which there are two, each capable of taking a sheet 42x36 inches, are located each at a window in the south end. The frames are mounted on small special trucks running on rails, and by these means can be pushed out for exposure to the sun. A feature which is of great advantage is that the plane of the frames may be placed at right angles to the sun's rays, thus making the printing when the sun is low on the horizon much

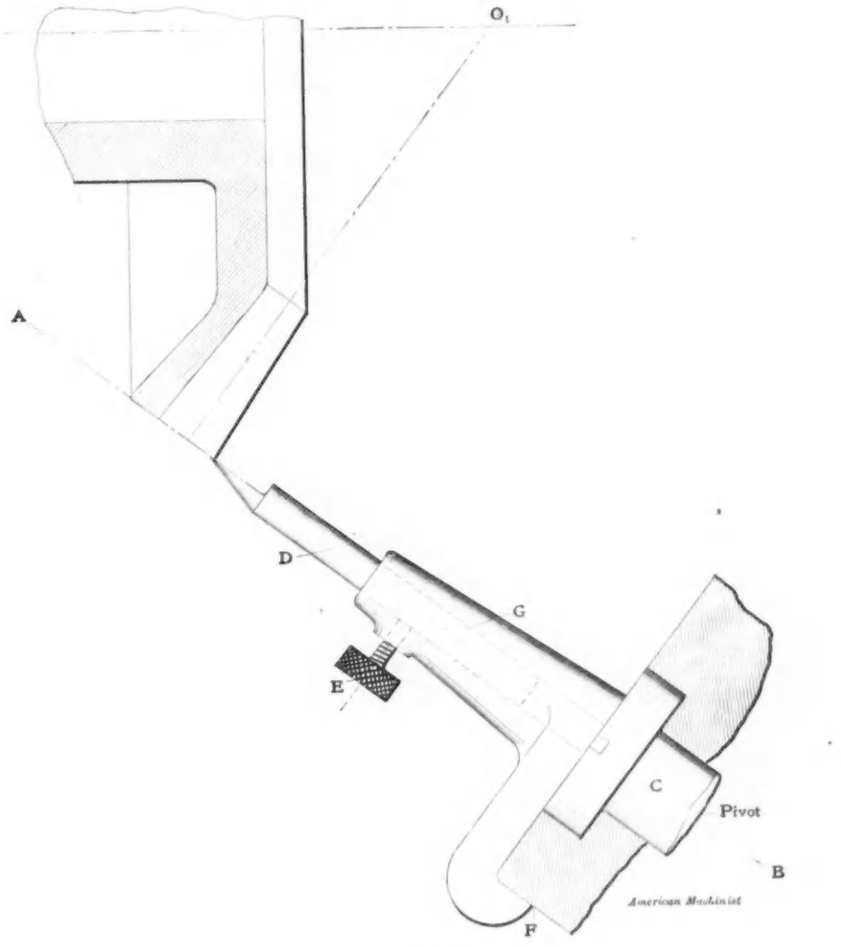


Fig. 5

METHOD OF ADJUSTING SLIDES AND PIVOT.

faster than it would otherwise be. A tank for washing the prints is provided. It is large enough for the largest prints, and is provided with water supply. Over the tank is a rack on which the prints are hung over small round sticks to drip dry. A chest of drawers and a large table on which to assort the prints complete the furniture of the blueprint department. Beside the blueprint tank there is a washstand for the use of the draftsmen.

Towards the north end of the room there is a fireproof vault, measuring 8x15 feet. It is built of brick arched over on top and provided with double iron doors. In this are kept the tracings and all records, so that they will not be destroyed in case of fire.

The drawing boards are 48x32 inches. They are mounted on adjustable desks, so that the hight of the board from the floor can be varied, and also its inclination from horizontal to almost vertical. Instead of the good old "T-square," some of the boards are fitted with a parallel straightedge, operated by fine steel wire running over a system of pulleys. The straightedge will remain in a given position though the board is vertical. This arrangement is very good when much detail work has to be put on the upper part of a large sheet, but it has some disadvantages, and for ordinary work the regular "T-square" is satisfactory. In addition to these drawing boards, there are some large tables provided. They are 4½ feet wide by 10 feet long, and are useful for full-sized drawings, when it is desirable to use a large scale for new designs, etc. The men in the office are as follows: Eight draftsmen, one stenographer, one boy for blueprinting and one for attending to the vault, also the chief draftsman—twelve men in all.

Form 31-3000-1-1900-K Co.

BULLOCK ELECTRIC MFG. CO.

PRODUCTION DEPARTMENT
WORKING ORDER.

Order No. 5408 *Date* April 17th, 1900 *Acc't of*

To be {*Delivered* / *Shipped*} *to* James Brown & Co., Boston Mass.

To be Completed November 21 st. 1900

Remarks

One - 200 K.W. - type H - belt driven - direct current generator

500 volts, at 450 r.p.m.

Order No. 5408

Actual Size of Sheet 8¼ x 11¼ inches *American Machinist*

Fig. 1

MANIPULATION OF AN ORDER.

In order to see how an order is handled in the office we will take one and follow it through. See Fig. 1.

This, we see, calls for a 200-kilowatt type H generator, 450 revolutions per minute, 500 volts, to be completed November 21, 1900. The order number, we notice, is 5408. An order similar to this is sent to each department in the factory, but, of course, no department can do its work until instructions are received. This applies to the drawing office also. Here we have to wait for information from the engineering office. If the new order is a duplicate of an old machine, or an entirely new design there will be a specification from the engineering office, giving the necessary information. As soon as the time comes to take up the work on this order, it is handed over to the draftsman who usually does this line of work, or, in case of some new line or special apparatus, it would be given to the man thought best able to make a success of it. This man makes the necessary drawings, many times using ones already made for former orders, and finally he writes up a list of the drawings, known as the "Drawing List." This is described under head of "Drawing List," and is shown in Fig. 2, *a* and *b*. We will now return to consider the "order" again, which we left for a few moments. The orders are filed under three heads, as follows: Orders on which the drawing office work is not complete are filed by themselves and they are not removed therefrom until the drawing office work is all done. The second file is one of orders on which the drawing office work is complete, but which the factory has not finished. This is a very useful classification, as it shows at once what work there is in the factory in course of manufacture. As the orders are completed and shipped, notice is received from the shipping department and they are transferred to the final file of orders on which all work is done, both in office and factory. This file, of course, extends away back to the commencement of orders. These are filed in separate press paper covers and kept in the vault. More will be said of this later (see "Indexing Orders" and "Drawing Lists"). As the drawings are made, they may be turned in day by day, or they may be held until all on the one order are made. This is decided by circumstances in each case. If there is plenty of time for the completion of the work in the factory, a good plan is to hold all the drawings, in the case of a new machine, until all are finished. However, it far oftener happens that there is very little time, so information must be sent to the shop at the earliest possible moment, and the material ordered. In this case the drawings of those parts which it takes the longest to get will be made first—parts requiring new tools or castings needing new patterns.

DRAWINGS.

There are four sizes of drawings: The smallest, 9¼x13¼ inches, the sheet for which is shown in Fig. 3; the B sheet, 30x40 inches; the C sheet, 20x30 inches; the D sheet, 15x20 inches. The 9¼x13¼-inch size is used far more than any of the larger sheets. It is a printed form and comes to us as shown in Fig. 3. For this size we use No. 18 Bond paper (Crane & Co.) and also ordinary tracing linen—the latter, when it is desirable to trace a part of an old drawing. For the B, C and D sheets, tracing linen is used. As far as possible the small sheet is used, one part being placed on each one, the B, C and D sizes only being taken when the smaller ones would mean too great a reduction in scale.

Placing only one part on each drawing has these advantages: The piece can be used on any machine by simply calling for this particular drawing. The drawings are comparatively simple, are small and consequently easy to handle. There are some disadvantages, however. One of these is, that the relation of the different parts of the machine to one another is not shown, and therefore the workman is not able to use his judgment in fitting one part to another. This has to be overcome by marking the drawing carefully with finish marks and by specifying the kind of fit required at any particular place. Assembly drawings are made when necessary. These, of course, show the relation of the various pieces, call for such parts as washers, bolts, band wires, etc., and show centerline dimensions and other general information which cannot be put on a detail drawing.

NUMBERING AND FILING DRAWINGS.

The small-sized drawings, 9¼x13¼ inches, are numbered consecutively, starting from 100. Each one, as it comes, is given the next number. For this purpose an index book is kept. It has three columns, one for the drawing number, one for the name of the piece the drawing represents, and one for the order number for which the drawing is made. The numbering of the B, C D drawings is in another series, running from 100 up and preceded by the letters B, C or D, as the case may be. These drawings are filed in drawers, all of the same letter being together. The small sheets are filed in lots

of one hundred and the numbers run consecutively. The one hundred are put in a simple cover made of heavy press paper, and this lot is then put in its place in a case made for the purpose in the fireproof vault.

When a drawing is wanted, a small card, Fig. 4, is filled out with drawing number and signature and is given to the boy in charge at the vault, whose duty it is to see that the drawing on the card is delivered. If the boy is busy and there is no immediate hurry for the drawing, the card is dropped into a wire basket reserved for this use, and is attended to as soon as possible. This card is filed away in a convenient box and is a receipt for the drawing, and thereby a drawing can be easily located. It applies particularly in the case of a changed drawing, for then all the prints in existence in the factory are to be changed; and to be able to locate them easily is of great help. It may occur to someone that this must cause a loss of time in securing a drawing. This is overcome in a great measure by having a complete set of the drawings bound in press paper covers in a simple book form; there are 100 drawings in a cover, and these are filed in a suitable case. These are out in the open office, and can be referred to by anyone. They are for reference only, and are not to be taken to the drawing boards, the loose sheets filed in the vault being for this purpose. Here, it may be noticed, there are two other such files, one in the superintendent's office for the use of the "bill of material clerk," and one in the office of the shop superintendent for his reference.

DAILY BULLETIN OF DRAWINGS.

A feature which helps to make the management of the drawings easy is the daily bulletin of drawings. This is simply a list of the new drawings issued and of the changed and canceled drawings for each day. As a draftsman finishes a drawing he places it on the chief's desk. When the chief draftsman is satisfied with it, he puts it into a wire basket kept to receive the drawings, and there they wait until they are taken out to be written up for the bulletin. This is done each morning at 11 o'clock. It is written up on the typewriter, a preliminary copy only being made at first, as it is subject to change, as will be made clear later. When the final corrected bulletin can be issued, copies are sent to the shop superintendent and to the blueprint department. This list is use-

Form No. 55—1000. 10-99. S.P.W.

BULLOCK ELECTRIC MFG. CO.

LIST OF DRAWINGS.

	Pattern No.	Ent. on Draw'g List.	Noted by Spec. Dept.	Drawing No.	No. Req'd

Date of Information Added by Drawing Office. Incomplete

" " Noted by Specification Dept. Complete

K. W. Gen'r.

H. P. Motor ------- Revs. ------- Poles Volts.

Order No. ---------

Signed ---------- Date ----------

American Machinist

Actual Size of Sheet 9½ x 13¾ inches

Fig. 2a

LIST OF DRAWINGS.

	Pattern No.	Ent. on D'w'g List	Noted by Spec. Dept.	Drawing No.	No. Req'd.		Pattern No.	Ent. on D'w'g List	Noted by Spec. Dept.	Drawing No.	No. Req'd.
Outline,						Punching Armature,					
Assembly,						" " Slot,					
" of Armature,						" Pole,					
" of Commutator,											
						Rails,					
Armature Connections (Commutator),											
" Former,						Rocker Arm,					

Date of Inform. Added by D'w'g Office. Incomplete

" " " Noted " Spec. Dep't. Complete

K. W. Gen'r.

H. P. Motor ---- Revs. ------ Poles. Volts.

Order No. ---------

Signed ---------- Date ----------

American Machinist

Actual Size of Sheet 9½ x 13¾ inches

Fig. 2b

ful in the blueprint department in showing just exactly what has to be printed in the way of regular work. It is useful in showing the changed drawings, the shop superintendent being responsible for the recall of changed drawings and for their return to the drawing office. (See "Changed Drawings.")

INSPECTION OF DRAWINGS.

It should be noted that drawings are not examined as to correctness of figures in detail after they leave the draftsman's hands. It was found that this caused the men to become careless. Each man is responsible for his own work when he hands it in, and if he makes mistakes, too many or too serious, the company cannot afford to employ him. This plan has been very successful, and very little trouble has arisen from mistakes in the drawings.

Each day at 1 o'clock the drawings on the "bulletin" for that day are examined by an examining board, consisting of the superintendent, vice-president, engineers and chief draftsman. Here the drawings are criticised, and any changes which are suggested are discussed and decided. If a drawing is unsatisfactory it is not passed, but is removed from the "bulletin." The members of the board initial the "bulletin" and become responsible, in a general way, for the designs embodied in the drawings. From the corrected list the final "bulletin" is written up, as explained above.

DISTRIBUTION OF DRAWINGS.

When the drawings come from the examining board the chief draftsman takes them and, having had all changes made, signs them and turns them over to be blueprinted. Having been blueprinted, dried, cut and trimmed, they are put in their various places. There are three complete files, bound in books of one hundred each, one loose print for the use of the drawing office and one or more for the shop. The shop drawings are mounted on felt board; this makes them easy to handle and prevents their being lost or stolen. The shop drawings, having been mounted, are placed in the care of the boy who has charge of the vault. They are kept in a case outside the vault, and are not given out without a proper order and receipt. In the shop each department has an order for each piece of work; this is issued by the shop superintendent, and gives the drawing number. When he wants a drawing, a card (Fig. 4) is filled out and sent to the shop office, where a duplicate card is made out. This duplicate card is given to the messenger in exchange for the one he brought, which is filed in a compartment marked "Waiting." The messenger takes the duplicate card up to the custodian of the drawings. If the drawing is ready the messenger puts his initials on the card, and, leaving it as a receipt, takes the drawing. If, however, the drawing is not ready, the card is placed in a compartment marked "Waiting," and here remains until the drawing is ready. When the messenger gets the drawing, he takes it to the shop office, gets the card he originally left there, and takes the card and drawing to the foreman, who signs the card and sends it back as a receipt for the drawing. This is kept on file so that at any time drawings may be located.

THE BULLOCK ELECTRIC MANUFACTURING CO.

Order No. [redacted] CINCINNATI, O.

3200-1 4-16-00 Nuts Tapped ½"	3200-2

Material No. Reqd.

3200

Actual Size of Sheet 9¼ x 13¼ inches American Machinist

Fig. 3.

CHANGED DRAWINGS.

It has been said "There is nothing so constant as change." This certainly has an illustration in drawings, and, therefore, some method of keeping a record of the changes is necessary. Also a scheme which will insure the destruction of the old prints is important.

This record is kept on the drawing itself, as follows: Referring to Fig. 3, the number 3,200 is noticed in large figures, and above it is 3,200-1, this being the number of this drawing. An example will make clear the method of keeping the record. Suppose the drawing is of a special nut of some kind, and, as first issued, this nut is marked to be tapped ½ inch; we now wish to change this and tap the nut ⅝ inch. Under 3,200-1 would be written, "nut tapped ½ inch," then a vertical line from the 2-inch line is drawn, enclosing this note and the figures 3,200-1. The drawing is now called 3,200-2 and is ready, after approval and signing, to be printed again. Often changes are so radical as to necessitate a new drawing. It is apparent that there is soon a limit to the changes which can be recorded as above. Still the majority of the changes are unimportant, and this method has filled a long-felt want. If a new drawing has to be made, and it replaces an old one, the old drawing is stamped, "Canceled—Superseded by drawing No. ——," and is reissued, so that all prints will show this information. The new drawing is marked, "Supersedes drawing No. — —."

As has been already said, where a drawing is changed all prints have to be called in and new ones issued. The shop superintendent is responsible for the prints in the shop, receiving his information by means of the "bulletin." The blueprint force looks after the prints in the drawing office. There is a form used in the blueprint department, which is shown in Fig. 5. Each drawing is allotted several lines, each line for an issue. By filling this up a record is kept of the number of prints made of each drawing, and when it is necessary to reissue a drawing it is easily seen how many new prints are required.

PATTERNS.

The patterns are numbered in the drawing office, the numbers running consecutively, and prefixed by a letter. The numbers from 1 to 9999 having been used, and not wishing to use more than four figures on a pattern, the letter "A" is prefixed, the next pattern then being A-1, and so on up to A-9999.

Form No. 1. 5 M 12-99. N. P. Co.

Drawing No. .....
Order Sheet No. .....
Bill of Material No. .....
Diagram No. .....
Tag No. .....
Signed ..... **Date** .....

American Machinist
Drawing Order Card
Actual Size 2 x 3¼ inches

Fig. 4

The pattern number originally occurs in a book, which has columns and headings, as follows:

Pattern No.——Pattern No. Changed to number below——Drawing No.——Name or description of pattern——Order No.

If loose pieces are made to use in connection with an existing pattern, they may be marked with the pattern number and letter to distinguish them. An example will make this clear:

We have pattern D-6000. This makes a certain casting as it is, and is a standard piece. Now, if we want another casting similar to this, but with the addition of some lugs, these lugs are made loose and marked "D-6000-A." In ordering the casting then, the order calls for, say, three castings, Pattern No. D-6000, with loose pieces, D-6000-A.

If we desire another casting with another variety of lugs, these can be marked

D-6000-B. A note of these letters must be made in the pattern book when they are used, or there is danger of using the same letter twice, which would cause confusion and mistakes. A point which is of great importance in connection with pattern numbers is this: If a pattern is changed, give it a new pattern number, otherwise the pattern maker may not make the change, the pattern may be sent off to the foundry and the casting be not what is desired. Changing the number is a sure way of calling it to the attention of the pattern maker. Of course, the drawing has to be changed to correspond, but it would have to be altered in any case to show the change in the casting itself. In order that the foreman of the pattern shop may know what to make, he makes a copy of the pattern book. He can then see what is ahead of him and also which patterns are required on certain orders. He knows which orders to select to work on, from his "Preference List," on which the orders to be completed first come first.

TOOLS.

Here I will only speak of such tools as are special and require the attention of the draftsmen. The drawings for tools of this kind are made by a man directly under the shop superintendent, and he is not in the drawing office, so that his work does not come directly under the chief draftsman. However, this is not essential; all that is desirable is that the drawings pass through the hands of someone capable of deciding what tools are necessary, and, if any special ones are wished, either to make the drawings or have them ordered. This is work with which the shop superintendent would naturally wish to be in close touch.

All tools are given numbers in the same manner as the patterns, and in order to see what there is to make, it is only necessary to glance at the Tool Book. This will also tell at once what new tools are required on any given order, which is often of great convenience.

DRAWING LISTS.

This is the formal method of furnishing information from the drawing office (see Fig. 2, *a* and *b*). When the drawing list is written up on a particular order by the draftsmen, this list is turned over to the chief. When he is satisfied that it is all right, he places it in a wire basket marked "Deliver." It is then taken to the Specification Department, where a bill of material is written up. This man is also in close touch with the stock-room and the purchasing department, and for material not in stock he sends a requisition to the purchasing agent, through the superintendent, the purchasing agent not ordering it unless initialed by the superintendent. The bill of materials shows the drawing numbers and pattern numbers of the parts, the amount and kind of material and also the date when ordered. This is made out in duplicate, one copy being retained in the Specification Department and the other sent to the shop superintendent. This is all the information the shop gets as to drawings required on an order. In the drawing office there is kept a drawing list for each individual standard machine. When an order for such a standard machine comes in, it simply means copying the standard list, and putting down the order number, both on the standard list and on the new list.

In the distribution of work in the drawing office, there is a great field for the appreciation of any man's peculiar qualifications. Some men are fitted for one kind of work and others for another kind, and to find this out is one of the conditions of successful and easy production.

We have a good many different styles of machines. Three of them are: Type H (belted generators), type I (direct connected) and type N (small enclosed motors).

It is a good plan to specialize as to the work. If a man is familiar with the type H work, and there is any work of this kind to do, let him do it; if it is possible, avoid giving it to a man who is not familiar with it, and so on with the rest of the work—one man or more, if necessary, for any given type. This saves time and gives better results than letting any man take the next thing which comes along. There is a certain amount of general work to be done and a good all-round man should be selected to do this.

If there is too much work in an office for it all to be handled by one foreman, then another foreman may be appointed, or as many as are necessary, each having his particular line of work and all responsible to the chief draftsman. These foremen may have as many men under them as their work demands, or as they can manage efficiently.

KEEPING RECORDS.

Nothing is more important to a manufacturing company than the keeping of records of what is sent on certain orders. The drawing office record is the drawing list. When a drawing list is completed, it is so marked and dated, and, when it has been returned by the Specification Department, it is blueprinted. These blueprints are bound in a press-paper cover and kept on file in the drawing office so that they may be readily referred to.

The original drawing list, the formal order, and any sketches and notes referring to this order, are then put in a paper cover, plainly marked with the order number, and this is filed away in the fireproof vault, as a matter of record.

Drawings from outside persons, which are of more interest than for the particular order on which they are received, are given a number and called "Outside Miscellaneous No. ..." If a drawing is so filed, a reference is made on the face of the formal order, "See Outside Miscellaneous No. ..."

INDEXING ORDERS.

It is often a matter of necessity to find an order number from some other information which may be remembered about the order. For example—the 200-kilowatt generator, mentioned above. Six months after its shipment we may wish to look up some point about it, but may not remember its order number. We may remember, however, that it is a 200 kilowatt,

RECORD OF BLUE PRINTS.

DRAWING NUMBER.	Rec'd to Print.	PRINTS DELIVERED TO										REMARKS.
		Sup't.	Office Book.	Office Drawer.	Number to Agents.	Number for Stock.	SHOP.	Mounted.		Office.		

DRAWING No. DATE

Actual Size of Sheet 8⅝ x 10¾ inches American Machinist

Fig. 5

this is a 200 kilowatt,

type H, and so by referring to the index, find the order number.

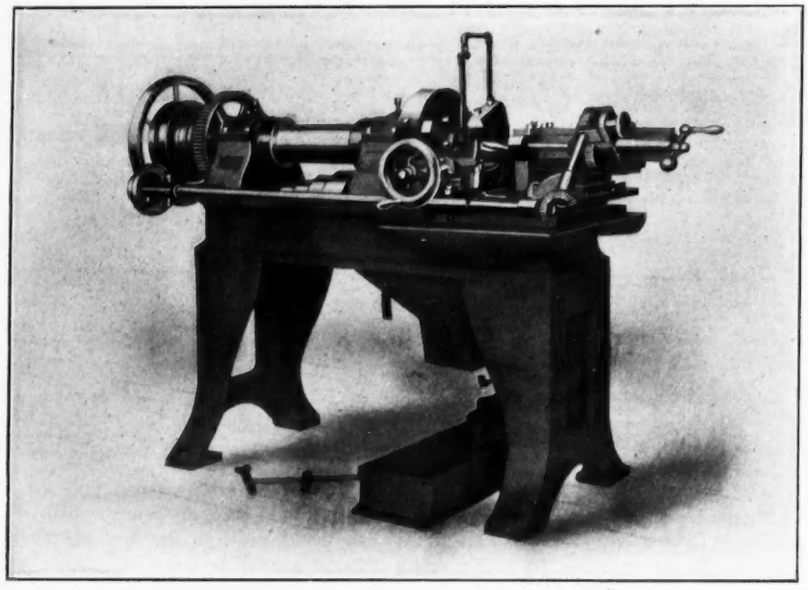
The index is made up in two ways—classified under rating (i. e., horse-power or kilowatts output) and under the type of machine and its size. The above would be type H No. 12.

STANDARD BOOKS.

Each draftsman is supplied with a small leather binder, about 7x4 inches, and in this keeps blueprints which show standard sizes of bolts, washers, copper carried in stock, etc., etc. These sheets are made for this purpose and are of great convenience.

A Combined Cutting-Off and Centering or Drilling Machine.

The half-tone shows a cutting-off machine to which has been added a drilling attachment. The machine is used for cutting off round, square, hexagon, or other shapes of stock, and when holes of any size are required, as for rolls, collars, dies, etc., the drilling may be done at the same time, and the drill also may be used for centering work. Both hand and automatic feeds are provided for the drill, and the cutting off may be with or without constant cutting speed, as required. The machine is made by the Hurlbut-Rogers Machine Company, South Sudbury, Mass.



COMBINED CUTTING-OFF AND CENTERING MACHINE.

Letters from Practical Men

Some Shop Experiences.

RENDER UNTO CAESAR.

Editor American Machinist:

When the Old Man comes in with an idea that he wants worked up on the board and it proves to be a good thing, as it often does, let's give him credit for it. He is pretty sure to get it anyway, and on general principles it's safest to let him have it. That's policy. We may have little faith in the scheme until it gets pretty well along in the shop, and then it may appear so beautiful that we are tempted to claim it as our own, such forgetful creatures are we. When our assistant, at $10 (or is it $20?) a week, schemes up some useful device without any of our assistance whatever, let's show him we recognize his ability and speak a good word for him with the Governor. That's appreciation, and is rewarded by more faithful service.

When we get up something on our own responsibility and it's a success, let's not be bashful in claiming the credit for it. That's business, and business nowadays consists to a certain extent in advertising one's specialty, whether it is inventive ability or something else. Quite a long time ago I had the pleasure of spending some little time in an interesting shop "over yonder." The superintendent in showing me about the place was particularly anxious that I should see some special machinery they had working on one of their products. They were very interesting machines and doing beautiful work, and I expressed much pleasure in having an opportunity to see them working. "Well," said the superintendent, "I spent a good deal of time and thought on those machines—in fact, worked them up from the very beginning. We had to have something to do the work with, and now that these machines are in operation, I'm pretty well satisfied with the result of my labor." A little later I was told by a man who is on the inside of pretty much everything that happens at that plant, that the manager of the concern, an acquaintance of mine and a very practical man, had originated those machines and worked out the whole scheme. I didn't have an opportunity to talk with the foreman of the floor where they were built, but am of the opinion that had I done so, I should have learned incidentally that he—though of course he wasn't saying much about it—was largely instrumental in the devising and building of that lot of machinery. Well, undoubtedly several people had a hand in the affair—they usually do—but some one person must have conceived the idea originally and started the ball a-rolling, and I occasionally wonder who it was.

THIS MAN DIDN'T CARE FOR MACHINE TOOLS.

I met him first in Brussels, during the Exposition held in that city in 1897, and have always thought of him as something of a mechanical curiosity. He worked for a company engaged in the building of machinery, and claimed to be something of an engineer himself. I mentioned several tools I had seen about the Exposition, and supposed he would be glad to see them; but no, he said he didn't have any time to bother with machine tools, and didn't care to see them, anyway; he had rather spend his time looking around other sections of the building. I asked him if they didn't use machine tools in the shop where he worked, or what did they use to build their old machinery with, anyway? Did they carve it out of the solid by hand, or did they glue it up from plates? "Well, of course, they used tools the same as other people; but what did special tools amount to? They were only means to an end, and anything that would cut metal was good enough, even if it wasn't the latest thing from America." This man was not an American; but I hardly need mention the fact; I think it's evident already. Now, some time ago I heard that this gentleman had come to this side, and had "accepted a position" with one of our leading machine-tool builders; and when I received the information I concluded that our friend must have suddenly realized that even in *this* line there might be something interesting and well worth investigating. In conversation with the manager of the concern a little later I remarked that I understood Mr. So-and-So was with him now. "Well," said he, "he *was* with us for a time, but didn't tarry long. He was a wonderfully good man to talk." Can it be our friend found the atmosphere in the vicinity of machine tools altogether too invigorating for his comfort? Who knows?

SALARY EXPECTED, ETC.

A good many of us have had something to say on the subject of "Salary Expected," "Salary Received," "Salaries We Didn't Get," etc., but how many of us are willing to say anything about "Unsuccessful Bluffs We Attempted to Work" in connection with the salary question? Personally, I have had some valuable experience in this particular line; as I recall it, I believe it was expensive experience, too; but we are told that the best things come high, which

is doubtless true, even if oftentimes inconvenient.

I never cared much for responsibility without proportionate compensation; so one day when the superintendent came in and asked me to take charge of a little larger job with a great deal more work in connection with it, I, of course, quite naturally asked some questions regarding recompense. "Oh, well, that will be all right," I was informed. "Just let it stand for a day or two if you don't mind. It will be a great accommodation if you will take up the work immediately." You see, this was a new shop, with a lot of special machinery, and there were a good many unskilled men to be broken in. It is easy for me to see at this late day that I was particularly verdant at that time, for I ought to have had the matter settled on the spot. But perhaps I was more ready to accommodate in those days. As the days went by I heard nothing said about that increase of salary; but hearing in the meanwhile more or less about my employer's business methods in general, I grew suspicious, and raised the question again, with the result of more shilly-shallying, more "wait a day or two" diplomacy. This eventually grew monotonous, so I decided to get the matter settled one way or the other, and informed my superior that the beginning of the following month I should have to have a certain salary if I were to stay longer. If the money was not forthcoming I should be going. "Oh, yes, yes," he would see that that was made all right; of course they had to keep me; couldn't think of letting me go, etc., and I actually began to think I should stay after all. The last day of the month arrived, and along towards night in came my friend with a long face. No; the management wouldn't consider letting him pay that amount of money; they thought they could get the work done for less. He didn't see how he could spare me, and of course I wouldn't mind staying awhile longer. He would see that things came out right after a little. "No, thanks," said I. "Goodbye. This climate doesn't agree with me anyway, and my physician advises me to seek a change of air." Now the location was a particularly pleasant one, and I candidly admit I hated to leave that vicinity; but I had stated what I should do under certain conditions, and didn't see any graceful way to back down. I had felt pretty sure of their accepting my terms, and had made no effort to look up a suitable place in case I was obliged to move; consequently, by the time I was at work again I found it would have been money in my pocket to have stayed where I was a little longer. There was one consolation in connection with my inability to get what I kicked for; the next man who took the job had to go to work for even less than I had received, and I believe he left after about the same length of time.

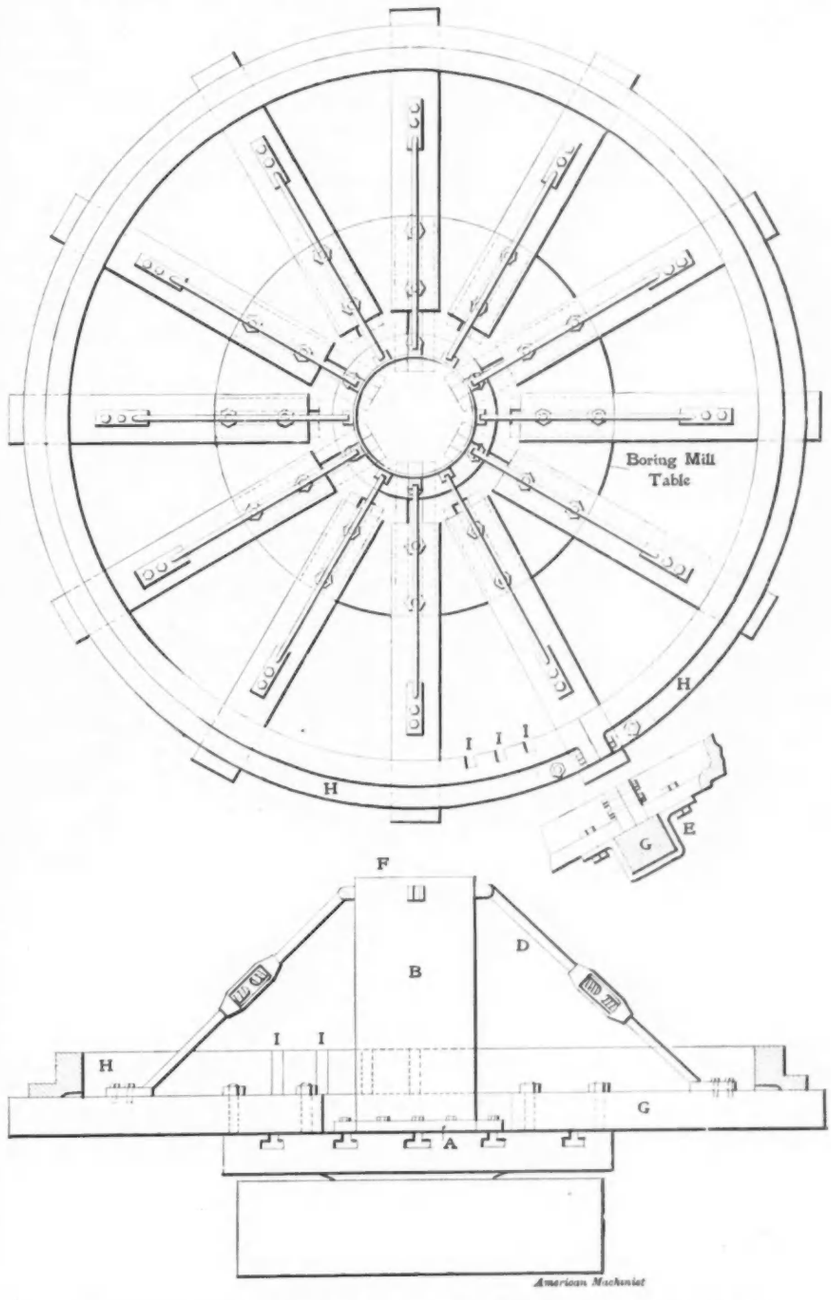
S. F. ARTHUR.

Machining Circular Racks for the Turrets of the Kearsarge.

Editor American Machinist:

I am greatly interested in the Letters from Practical Men, and especially in the ways of getting around a job that is too big for any machine in the shop. I send a sketch of a job in which I was interested. It was the turning of six circular racks, to have internal teeth, for the turrets of the battleships "Kearsarge," "Kentucky" and "Illinois."

They were about 16 feet outside diameter, 13½ feet inside diameter and 8 inches high. We have a 16-foot boring mill in the shop, but the table is only 8 feet in diameter. The way the boss got around it was this (the sketch is not to scale): We got a 12-inch iron flange *A*, threaded to fit a piece of 12-inch heavy iron pipe *B*, 36 inches long; twelve bars of 4x4-inch wrought iron *G*, 7 feet long; twelve 1-inch rods *D*, threaded right and left for turn buckle, and six clamps like *E*. The flange, with pipe screwed in, and pieces *F* screwed in the pipe, was clamped to the boring mill table with 1-inch bolts. The bars *G* were clamped to the table with 1¼-inch bolts; the rods *D* were fastened to *G* with 1-inch tap bolts and to *F* with 1¼-inch pins. The right and left-hand nut on *D* was drawn up on each bar, so as to bring each one nearly true, and a cut was taken



MACHINING THE CIRCULAR RACKS FOR THE TURRETS OF THE "KEARSARGE."

over the bars to bring each one true to the width of the ring *H*. The ring was made in six sections, and a clamp *E* under the joint of the two sections held the ring on the bars *G*. The ring was cast steel, cored out as shown at *I* for the tooth spaces. It was faced on the top and the bottom, bored on the inside and then shipped away to have the teeth cut. Please excuse the sketch, as that part of the business is not in my line. A MACHINIST.

Newport News, Va.

The Method of Invention.

Editor American Machinist:

On page 48 of No. 18 you quote Harvey's reply to his son's idea of the proper way of going about the invention of some specified thing. It reads well, and there is an element of truth in it. But I doubt very much if 1 per cent. of the inventions that have amounted to anything have been made by men who had not worked for some time along the general lines of the art which their invention concerns, and thereby, consciously or unconsciously, obtained a fairly definite idea of "the state of the art;" that is, what other men have done in that art.

The patents that swamp the patent office without helping anyone are, I believe, almost wholly those gotten out by people who have brilliant ideas relating to lines along which they have never worked; and I believe the converse of this; the valueableness of patents taken by men more or less expert in the art supposed to be improved, applies as well to born inventors as to more common workers. The born inventor, the true genius, need not be as familiar with the details of the art as his less gifted brother, but almost invariably his invention will spring from the realization of the shortcomings of some existent device—that is, some one else's work in that art, and something which he must understand if he can criticise and improve.

If I undertake to design a machine to form a new style of hook and eye, I need not know all that has been done in hook and eye machinery, though I would doubtless avoid some expensive experience if I did. But I must know the general state of the art in machines for bending wire, or I shall certainly have to begin somewhere near where very bright and able men started fifty years ago, and come out very far below the knowledge of thousands of machinists to-day.

I write this because, while I think nothing can be accomplished in invention by men fettered to the present practice, and that to invent one must be willing and anxious to break away from established lines, yet I think the paragraph referred to might be interpreted as advising one to ignore the accumulated experience of very able men in the art under consideration, and no mistake could be worse than this.

KLOGS.

The Theoretical and the Practical.

Editor American Machinist:

In your issue No. 18, under Questions and Answers, you make the statement, referring to a crank and an eccentric both having the same throw, "They would both require the same theoretical power for the same work, but there would be more friction with the eccentric," etc. Why is not the resistance due to friction just as much of the theoretical resistance as that due to lifting a weight? It would seem to me that the "American Machinist" should do what is in its power to break down, not to establish, the oft-raised question of theory *versus* fact. Theory and fact are never antagonistic; in the very meaning of the terms they cannot be. Theory, when used in an engineering sense, does not mean a guess, but it means a statement of truth which successfully withstands every test which can be applied to it. As soon as fact truly contradicts a theory, the theory instantly ceases to exist; the combination of words formerly called a theory ceases to fulfill the definition, and so theory cannot coexist with contradictory facts. Theorem, rather than theory, in its popular use outside of science, conveys the idea of theory as used in engineering. Our theories are often—in fact, generally—incomplete, so we have to fall back on isolated facts, not yet sufficiently analyzed to permit a theory from which we can work deductively.

To come back to the case under discussion, the work done by friction is certainly a matter which yields to theoretical consideration, and the point raised—that more frictional work will be done in driving a rod from a crank pin of large radius than from one of smaller radius, other conditions remaining the same—is as clearly demonstrable on theoretical grounds as is the fact that it takes more energy to lift two pounds than to lift one, other conditions being unchanged.

Since writing the above, I have looked up the definition of "theory" in the Standard Dictionary. It reads: "A plan or scheme subsisting in the mind, but based on principles verifiable by experiment or observation; *strictly*, a rational explanation (especially as exclusive) that *agrees with all the facts and disagrees with none*: in this sense, *opposed to* or a final result of *hypothesis*."

S. L. G. KNOX.

[It seems to us that our correspondent rather overstrains the matter in his effort to make a point against us. If he has been a constant and diligent reader of our columns, he must know that we believe and assert that theory, when correct and complete, always coincides with practice, and that when theory errs it is usually through not embracing all the factors in a case. Where identical work is done by two different cranks, the pin of one of which is larger in diameter than the other, or is, if you please, an eccentric, the theoretical and the practical work is the same with each, except that which is theoretically and practically due to the one different condition—the enlarged diameter. If any other of our readers received an incorrect impression from our explanation, we trust they will let us know it.—Ed.]

Making That "Simple" Pattern.

Editor American Machinist:

The "American Machinist," No. 18, contained an article, "Different Ways of Making a Simple Pattern," by Mr. Willard. As the writer said, every pattern maker thinks his way the best; yet I think his way of constructing the pattern is hardly up to date, and I would scarcely recommend it to an apprentice as the best.

In the first place, it would take too much time in sawing out, jointing and building up the segments. In turning out the inside, unless you were very careful, the end grain at the joints would chip out, necessitating filling up when finishing. In molding there would be apt to be trouble with the core drawing with the pattern, as there is very likely to be more or less glue work out of the joints, caused by the moisture, if the pattern is in constant use.

I would recommend making it out of a solid block and turned inside. It would take much less time, and would have none of the objectional features before mentioned. If the pattern was for only one or two castings, making it with core prints for a dry sand core would be better.

A. HENRY.

"In the Hands of Friends."

Editor American Machinist:

The above quotation is from a recent issue of your paper, and had reference to certain machine tools that would only do good service when they were favored, or in the hands of friends. The "friend" of a machine may be positive, neutral or negative. If the first named, he will foster and favor it; if the second, the machine will have to stand wholly on its merits, and if of the negative kind, it is liable to get all sorts of neglect and abuse.

There is another thing that should be taken into consideration before a machine or appliance is condemned, and that is, is the machine being used for what and in the way it was designed to be used? If a man sees fit to use a lathe for pipe cutting, or for operating some milling attachment, and gets poor results, he ought not to condemn the lathe, for it might be an excellent tool for its legitimate work. One may often make an appliance for some special place or purpose where it is very efficient, but at the same time it may be impossible to use it on general work to good advantage, unless it be in the hands of friends who will overlook its defects and minimize its faults.

I once made a pipe wrench for use in a certain place where there was little room

to work. It was all right for this place, but not for general use, and I almost pitied the thing as I saw an irate workman throw it in contempt from where he was working and refer to the designer as a "—— idiot." He was ignorant of the origin of the wrench. I said nothing at the time, but took occasion to see that he was assigned to do some work in the place the wrench was designed for. After he had failed to do the job with standard tools, he was given the wrench he had "fired," and after using it successfully, remarked that "it ought to be chained near that place, so as not to get among strangers." In other words, it had to be in the hands of friends.

At another time there was a lot of heavy material to be unloaded from flat cars to trucks, and as it was to be a continuous show for several months, I got together an improvised crane or derrick to facilitate the work. It was in a restricted space between buildings, where it was possible to arrange guys to support most of the load, and the rig was all right for just that place. A year or two later a man came and told me that one of his men had broken a leg using my "freak derrick." Entirely without my knowledge he had bought the old rig and erected it for general use in a stone-cutting shed, where its surroundings were less substantial than where it had first been useful. It *was* a mighty poor derrick for a stone yard, but at home and "in the hands of friends," it would never have broken any bones.

There are other cases where friendship has been bought, and the seller has become the most abject slave. A good many years ago I accepted entertainment and other valuable considerations from a man who had a very vital part of a steam plant for sale, to wit, a pump. I had to be a friend (?) to that pump, even though I sat up nights to nurse it, and to invent new maledictions for it and its seller. I am devoutly thankful that I got this experience at twenty-three—I've never been friendly for a consideration since.

PETER H. BULLOCK.

Consuls and Consular Reports.

Editor American Machinist:

In your issue No. 16 you publish portions of Mr. George F. Parker's recent article on our consular service. With some of Mr. Parker's conclusions those most familiar with the service will take issue. He says, and correctly, too, that the system of appointment is essentially a spoils system. But the fact that the President appoints the consuls, and generally appoints his "trusted friends,"* does not necessarily imply that he will appoint men who are incompetent or dishonest, any more than in filling vacant judgeships he will appoint dishonest or incompetent lawyers.

The history of our Diplomatic and Consular Service has shown that its members have generally been men of fair intelligence and ability, who have represented the nation abroad with much credit. I believe this is true of the service to-day. That there may have been, and are, exceptions none will deny. I believe foreigners concede that our system is the best organized and most thoroughly vigilant and patriotic consular system in the world. That it needs some reorganization and some changes there can be no doubt; but it is far from being the inefficient service Mr. Parker's article portrays.

He is particularly severe in his strictures on the consular reports. American manufacturers and others who read these reports will not agree with Mr. Parker in his estimate of them. I submit that by no other agency is such a vast, interesting, valuable and, for the most part, accurate mass of information gathered together from all parts of the world as by the consular reports. Much of this information could be received in no other way, except by a public official living among the people themselves. My own observation is that our people generally understand this and seek the consular office first in their quest for information.

The consular reports cover nearly every possible field of inquiry. They are not always exhaustive, but they give suggestive hints as to what is being done the world over in manufacturing, shipbuilding, railroad and canal construction and other great enterprises. They throw light on the educational, industrial, banking, postal and other systems of the Old World. Well edited journals reproduce many of these reports as of value to their readers. Every consul is, in theory at least, on the watch for information that will be of use to his nation at home. He is not likely to be an expert in all departments. He may not describe machinery or processes as a machinist would do. He may report something that everyone knew but himself; but it is doubtful whether any body of men, selected by any process known to men, would, upon the whole, be more diligent and painstaking than the majority of our consuls are to-day.

As against the judgment of Mr. Parker on the consular reports, is that recently given at a dinner by one of the most distinguished members of our entire foreign service, and whose life has been largely identified with it. He said that nothing comes to his table that is more interesting and valuable to him than these consular reports, and that when one comes he cannot lay it down until he reads it through. This is the deliberate judgment of one of our most distinguished citizens, and the judgment is a sound one. What would do more to widen the view of many of our people at home as to the conditions abroad than a year's careful reading of these reports?

A CONSUL.

*Our correspondent here seems to be begging the question. Mr. Parker emphasized the fact that in cases too numerous the President does not appoint "trusted friends." Personal appointments such as these, he stated, are those which yield the happiest results, but in those cases which he particularly condemned the selection is made through "the recommendations of party senators, representatives or managers" which have "no direct reference to fitness."—Ed.

A Whizzer Accident.

James McMullen recently lost an arm in a laundry at Hutchinson, Kan. The accident is thus described in the "Hutchinson News:"

"McMullen stopped at the wringer and held his hands over it to dry them. He got one hand too low, so that the air suction caught it, and his arm from the elbow down was taken off as by a miracle. The wringer is a large circular iron affair, with a smaller bowl inside it in which the clothes are placed. The smaller apartment is perforated with holes upon the sides, and the whole thing revolves at the rate of several thousand revolutions a minute. The effect is that the air currents within the wringer are as terrific in their power as the center section of a Kansas cyclone. When a cyclone strikes a brick building and hurls it to atoms the force seems appalling and incomprehensible. The accident to Mr. McMullen was equally mystifying. The instant his arm came into contact with the current of air it was parted at the elbow. One part lay on the clothes that were in the machine and the other dangled from his shoulder. There was nothing about the machine to give him even a scratch.

"The nerve exhibited by McMullen was wonderful. 'It never touched me,' was the first thing he said. The girls in the room were screaming and McMullen calmly informed them that it was not his head that was taken off, and told them to be still. He was taken to a hospital and his arm was amputated close to the shoulder."

Prospering in Time of Prosperity.

From a business point of view the years 1898 and 1899 were extraordinary. I refer specially to Scotland, although the statement may well apply, in a general way, to the whole United Kingdom. They were both "record years" for the principal trades, the only prominent exception being the distilling industry. Investment companies and other financial institutions, as well as the majority of mercantile houses, wholesale and retail, enjoyed a degree of prosperity considerably above that of the average year. As a rule, both the volume of business and the margin of profit were greater than usual. The effect of this prosperous condition of the industries upon the masses of the people is a matter of interest. The professional classes and tradesmen have, on the whole, fared well. Skilled labor has had full employment, and, excepting printers and workmen in a few other trades, they have had wages from 8 to 10 per cent. higher than the rate which obtained in 1897. But

in Edinburgh, during the past two and a half years, the average advance in rents has been 25 per cent., and for a year the prices of meat and other food have been 10 per cent. above the average prices of 1897. There has also been a material increase in the cost of clothing, especially of cotton goods. Household coal, delivered to small consumers, is quite 50 per cent. higher than it was a year ago and costs not less than $6 per ton. In a word, owing to the increased cost of living, the earning power of even the best paid skilled labor has diminished.—From Report of Consul Rufus Fleming.

Legal Notes—Obvious Risk—Who May Sue.

BY WM. MARSTON SEABURY.

A man named Smith, who was employed by a manufacturer of cutting dies, and who was injured while truing a grindstone, recently lost the suit he had instituted in the Superior Court of Massachusetts, Middlesex County, to recover damages for his injuries.

The grindstone in question revolved on an axle set in metal boxes supported on heavy horizontal timbers. The stone was being trued by the plaintiff by holding against it a piece of iron gas pipe about 5 feet in length. The stone was revolving towards the plaintiff at the rate of not less than 100 revolutions a minute, and while so revolving the point of the pipe was carried down between the rest and the stone. The stone was revolving so quickly that Smith could not withdraw his hand, and a fellow workman, attracted by his cries, ran and pulled his hand out, but not until he had received injuries which made the amputation of three fingers necessary.

Smith contended, among other things, that the metal boxes on which the axle of the stone rested were too much elevated, so that the iron pipe necessarily came in contact with the stone 3⅞ inches below the center of the stone and that this intensified the danger of the iron being drawn under the stone by the inequalities in its surface.

Judgment for the defendant was rendered by the trial court, and on appeal the plaintiff's exceptions thereto were overruled, the court holding that the risk arising from the position of the stone was obvious, and for that reason was assumed by the plaintiff, and that, this being so, it was of no consequence that the defendant might have conducted his business with more safety. (56 N. E. R., 596.)

WHO MAY SUE.

The Supreme Court of Alabama a short time ago handed down a decision in the case of Woodward Iron Company vs. Cook. It appeared that John Cook was a boy under twenty-one years of age, and was employed by the Woodward Iron Company, among other things, for the purpose of checking the speed, to sprag the wheels of the cars used by the company to carry coal from the coal mine.

The action was brought in the trial court by W. H. Cook, the father of the injured boy, and resulted in a verdict and judgment in favor of the father of $1,450.

Cook, the plaintiff in the trial court, maintained that while a train of cars was being lowered into the mine, a car became derailed and ran over and injured the boy, and that the reason the car left the track was because a curve in the track at that particular point was not elevated as it should have been.

The Woodward Iron Company appealed from the judgment, contending that under Section 2590 of the Alabama Code, which is known as the employers' liability act, no cause of action was given the father for injuries sustained by his son.

The Appellate Court held that the liability which this act imposes upon the employer for injuries to an employee in cases of this nature is "to answer in damages to such servant or employee," if he survives the injury, otherwise to his personal representatives, and that as this right is created by statute it can be enforced only by the person to whom it is given. The judgment of the lower court was therefore reversed and the case remanded.

This case seems to recognize, however, the common law right of the father to bring an action against the employer to recover damages *for the loss of services* of his son, to which he was entitled, and there seems to be nothing in the case to indicate that this common law right does not still exist in Alabama. (27 S. R., 455.)

It is stated that in one of the shops of the United States Cast Iron Pipe & Foundry Company, Cincinnati, Ohio, the company has fitted up a room with drawing tables, boards and T-squares as a study room for the use of a number of its employees who are students of The International Correspondence Schools, Scranton, Pa. The class, which numbers about fifty men, and includes the general manager, studies on "company time" and is supplied with drawing paper by the firm. We are not informed how much "company time" is thus used. There are doubtless some who will question whether this is "business."

At the May meeting of the Franklin Institute of Philadelphia a prominent feature was a joint paper on Liquefied Air by Prof. Raoul Pictet, of Geneva, Switzerland, and Moriz Burger, of New York, particular attention being given to the separation of its constituent gases and their commercial application. The speakers both declared in very strong terms their lack of belief in the practical value of liquid air either for power or for refrigeration. A small liquid air engine was put in operation, and it developed about ½ horse-power for five minutes. To accomplish this four gallons of liquid air were used—including that lost by evaporation—and each of these gallons required about 4 horse-power for an hour for its production.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 24.

Caliper cat free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Shaft'g straighteners. J.H.Wells,Tampa,Fla.

For Sale—New bench lathe at cost of slide rest. Box 55, AMERICAN MACHINIST.

U. S. and Canada patent for sale, $150. Address Box 56, AMERICAN MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N.J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—To rent, a machine shop to employ 10 machinists; gas belt preferred. Address Box 62, AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Wanted, Immediately—Standard gage locomotive, weighing about 20 to 27 tons; state price, condition, location; must be cheap for cash. Room 723, Reaper Block, Chicago, Ill.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—A man with $10,000 to $25,000 to invest in a prosperous manufacturing enterprise in Texas, and capable of taking the superintendency of the mechanical end of the business, machine shop and foundry, now employing about 100 men. For further particulars address Chas. H. Besley, South Canal st., Chicago, Ill.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

A successful machine-shop foreman is open for engagement. Box 71, AMER. MACHINIST.

Experienced draftsman, technical graduate, desires position for July and August. Box 68, AMERICAN MACHINIST.

A young man who has had 3 years' experience in machine shop would like a position in machine shop or toolroom. Box 69, AM. M.

Mechanical draftsman, 10 years drawing room and shops; special and automatic machinery; near New York. Box 70, A. MACH.

A mechanical superintendent, who is a first-class manager and experienced in modern shop practice, tools, fixtures, etc., desires a change. Box 67, AMERICAN MACHINIST.

Machinist, first-class, all-round man, some experience as foreman, would like position with reliable firm in any capacity; references. Box 72, AMERICAN MACHINIST.

Wanted—Position as foreman, by first-class